installation, start-up and service instructions

SINGLE PACKAGE ROOFTOP GAS HEATING/ELECTRIC COOLING UNITS

581B
Sizes 036-072
3 to 6 Tons

Cancels: II 581B-36-1 II 581B-36-2
9/15/98

IMPORTANT — READ BEFORE INSTALLING

1. Read and become familiar with these installation instructions before installing this unit (Fig. 1).
2. Be sure the installation conforms to all applicable local and national codes.
3. These instructions contain important information for the proper maintenance and repair of this equipment. Retain these instructions for future use.

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SAFETY CONSIDERATIONS

⚠ **WARNING:** Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electric shock, or other occurrences which may injure you or damage your property. Consult a qualified installer, service agency, or the gas supplier for information or assistance. The qualified installer or agency must use only factory-authorized kits or accessories when modifying this product.

Recognize safety information. This is the safety-alert symbol. (⚠) When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words — DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. Danger identifies the most serious hazards which will result in severe personal injury or death. Warning indicates a condition that could result in personal injury. Caution is used to identify unsafe practices which would result in minor personal injury or product and property damage.

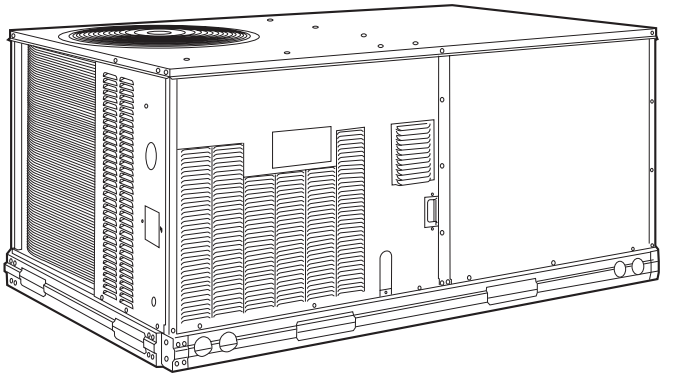


Fig. 1 — Typical Unit

⚠ **WARNING:** Disconnect gas piping from unit when leak testing at pressure greater than 0.5 psig. Pressures greater than 0.5 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subject to pressure greater than 0.5 psig, it *must* be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, a unit connected to such piping must be isolated by manually closing the gas valve.

⚠ **WARNING:** Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

1. The power supply (volts, hertz, and phase) must correspond to that specified on unit rating plate.
2. The electrical supply provided by the utility must be sufficient to handle load imposed by this unit.
3. Refer to the Locate the Unit section on page 3 and Fig. 2 for locations of gas and electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.
4. Locate the unit where the vent cap will be a minimum of 4 ft from openable windows or doors.
5. This installation must conform with local building codes, the NFGC (National Fuel Gas Code), ANSI (American National Standards Institute) Z223.1-1992, and NFPA (National Fire Protection Association) 54 TIA-54-92-1. In Canada, installation must conform with CAN/CGA (Canadian Gas Association) B149.1,[2]-M86. Refer to Provincial and local plumbing or wastewater codes and other applicable local codes.
6. Approved for outdoor installation on wood flooring or on class A, B, or C roof-covering materials.

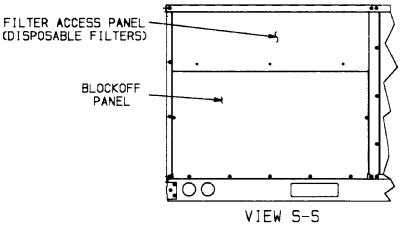
UNIT 581B	STANDARD UNIT WEIGHT		VARISLIDE™ ECONOMIZER WEIGHT		CORNER WEIGHT "A"		CORNER WEIGHT "B"		CORNER WEIGHT "C"		CORNER WEIGHT "D"	
	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg
036	530	240	34	15.4	127	57.6	122	55.3	138	62.6	143	64.9
048	540	245	34	15.4	129	58.5	124	56.2	141	64.0	146	66.2
060	560	254	34	15.4	134	60.8	129	58.5	146	66.2	151	68.5
072	615	279	34	15.4	147	66.7	142	64.4	160	72.6	166	75.3

	CONNECTION SIZES
A	1⅜″ Dia. [35] Field Power Supply Hole
B	2″ Dia. [51] Power Supply Knock-Out
C	1¾″ Dia. [44] Charging Port Hole
D	⅞″ Dia. [22] Field Control Wiring Hole
E	¾″-14 NPT Condensate Drain
F	½″-14 NPT Gas Connection
G	2½″ Dia. [64] Power Supply Knock-Out

NOTES:
1. Dimensions in [ ] are in millimeters.
2. Center of Gravity.
3. Direction of airflow.
4. On vertical discharge units, ductwork to be attached to accessory roof curb only. For horizontal discharge units field-supplied flanges should be attached to horizontal discharge openings, and all duct-work should be attached to the flanges.
5. Minimum clearance (local codes or jurisdiction may prevail):
   a. Between unit, flue side and combustible surfaces, 48 inches.
   b. Bottom of unit to combustible surfaces (when not using curb) 1 inch. Bottom of base rail to combustible surfaces (when not using curb) 0 inches.
   c. Condenser coil, for proper airflow, 36 in. one side, 12 in. the other. The side getting the greater clearance is optional.
   d. Overhead, 60 in. to assure proper condenser fan operation.
   e. Between units, control box side, 42 in. per NEC (National Electrical Code).
   f. Between unit and ungrounded surfaces, control box side, 36 in. per NEC.
   g. Between unit and block or concrete walls and other grounded surfaces, control box side, 42 in. per NEC.
   h. Horizontal supply and return end, 0 inches.
6. With the exception of the clearance for the condenser coil and combustion side as stated in Note 5a, b, and c, a removable fence or barricade requires no clearance.
7. Units may be installed on combustible floors made from wood or Class A, B, or C roof covering material if set on base rail.
8. The vertical center of gravity is 1′-6″ [457] up from the bottom of the base rail.

BOTTOM POWER CHART,
THESE HOLES REQUIRED FOR
USE WITH ACCESSORY PACKAGES —
CRBTMPWR001A00 (½″, ¾″)

THREADED CONDUIT SIZE	WIRE USE	REQUIRED SIZES (MAXIMUM)
½″	24 V	⅞″ [22.2]
¾″	Power	1⅛″ [28.4]



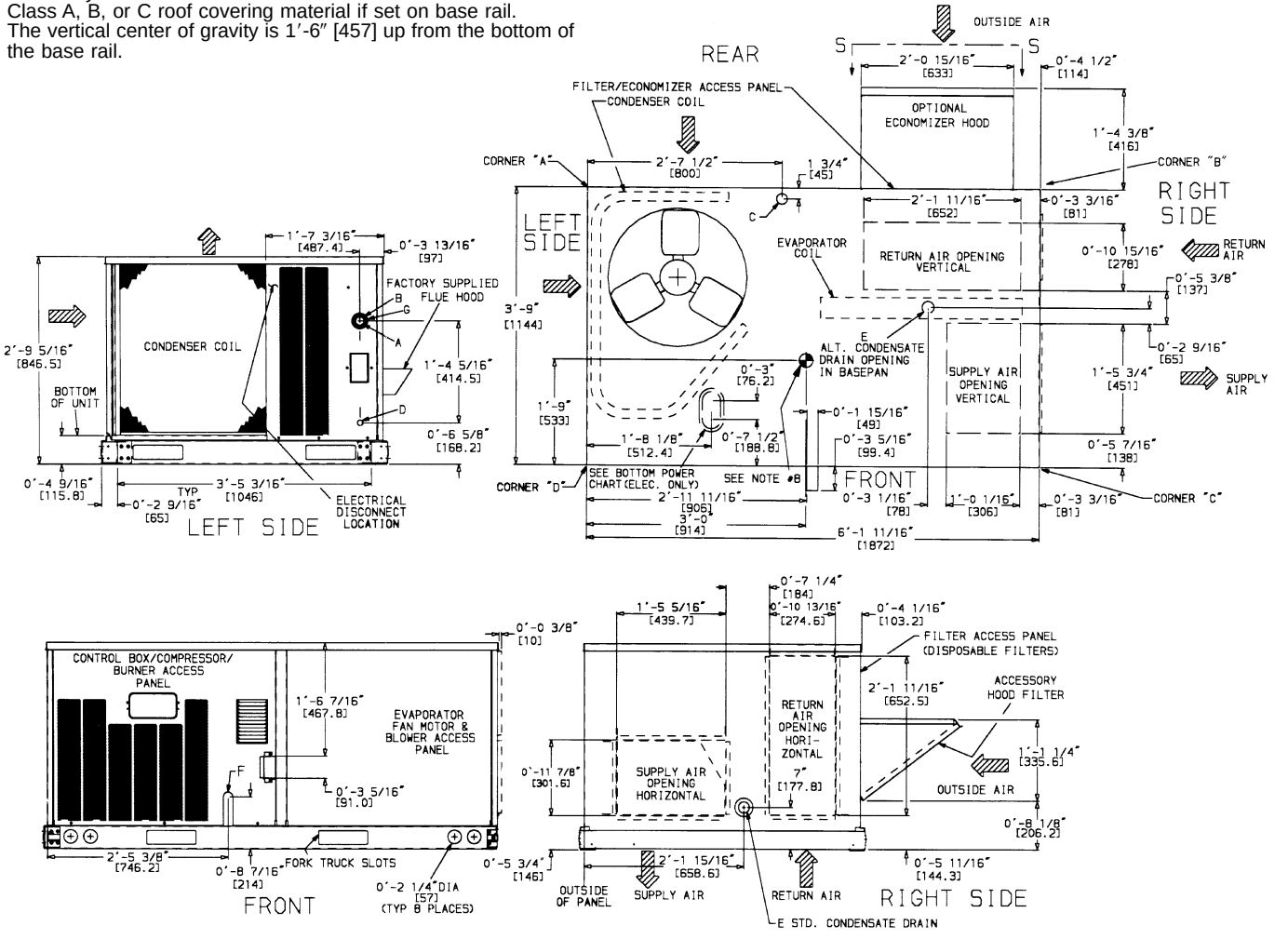


Fig. 2 — Base Unit Dimensions

INSTALLATION

Unit is shipped in the vertical airflow configuration. See Fig. 1. To convert to horizontal discharge, remove horizontal duct opening covers. Using the same screws, install covers with insulation-side down (facing outside) on the unit on vertical duct openings. Seals around duct openings must be tight.

Model 581B meets the California maximum oxides of nitrogen (NO_x) emission regulations when equipped with accessory NO_x Reduction Kit (part no. 309424-101).

These units are equipped with an energy-saving, automatic, electric direct spark ignition system that does not have a continuously burning pilot. All units are manufactured with natural gas controls.

These units are designed for a minimum continuous return air temperature of 50 F (dry bulb) or an intermittent operation down to 45 F (dry bulb), such as when used with a night set-back thermostat.

All units can be connected into existing duct systems *that are properly sized and designed to handle an airflow of 300 to 500 cfm per each 12,000 Btuh of rated cooling capacity.*

NOTE: When installing any accessory or factory-installed option, see the manufacturer's installation instructions packaged with the accessory or option. A qualified agency must use factory-authorized kits or accessories when modifying this unit.

I. LOCATE THE UNIT

A. Clearance

Maintain clearance around and above unit to provide minimum distance from combustible materials, proper airflow, and service access. See Fig. 2 and 3.

Minimum clearance to combustibles is 48 in. on flue side; bottom of unit (when not using curb) is 1 inch; bottom of base rail (when not using curb) is 0 inches.

Minimum clearance on all sides to block walls or any other grounded surface is 42 inches. Between unit and ungrounded surfaces, control box side is 36 inches; between units, control box side, is 42 inches.

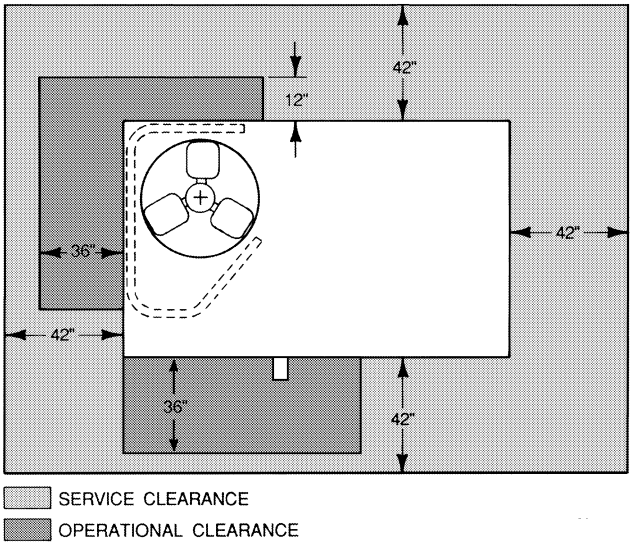


Fig. 3 — Service and Operational Clearances

Minimum clearance of condenser coil is 36 in. on one side, 12 in. the other. Side getting greater clearance is optional.

Minimum distance overhead is 60 inches.

Locate the unit where the vent cap will be a minimum of 4 ft from openable windows and doors.

Do not install unit in an indoor location. Do not locate unit air inlets near exhaust vents or other sources of contaminated air.

Be sure that unit is installed so that snow will not block the combustion intake or flue outlet.

Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Slab-mounted units should be at least 4 in. above the highest expected water, flood, and runoff levels. Do not use the unit if it has been under water.

Locate mechanical draft system flue assembly at least 48 in. from any opening through which combustion products could enter the building, and at least 24 in. from an adjacent building. When unit is located adjacent to public walkways, flue assembly must be at least 7 ft above grade.

Flue gas can deteriorate building materials. Orient unit such that flue gas will not affect building materials.

Adequate combustion-air space must be provided for proper operation of this equipment. Be sure that installation complies with all local codes.

Flue vent discharge must have a minimum horizontal clearance of 4 ft from electric and gas meters, gas regulators, and gas relief equipment.

B. Roof Curb Mount

Assemble and install accessory roof curb in accordance with instructions shipped with curb. See Fig. 4. Install insulation cant strips, roofing felt, and counter flashing as shown. *Ductwork must be attached to curb.* If gas, electric power, or control power is to be routed through the curb, attach the utility connection plates to the roof curb in accordance with the accessory installation instructions. Accessory electric and gas utility connection plates must be installed before unit is in place on roof curb.

IMPORTANT: The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasket with the roof curb as shown in Fig. 4. Improperly applied gasket can also result in air leaks and poor unit performance.

Curb should be level. This is necessary for unit drain to function properly. Unit leveling tolerances are shown in Fig. 5.

C. Slab Mount (Horizontal Units Only)

Provide a level concrete slab that extends a minimum of 6 in. beyond unit cabinet. Install a gravel apron in front of condenser-coil air inlet to prevent grass and foliage from obstructing airflow.

NOTE: Horizontal units may be installed on a roof curb if required.

ROOF CURB ACCESSORY	"A"	UNIT SIZE
CRRFCURB001A00	14″ [356]	581B036-072
CRRFCURB002A00	24″ [610]	

NOTES:
1. Roof curb accessory is shipped disassembled.
2. Insulated panels.
3. Dimensions in [ ] are in millimeters.
4. Roof curb: galvanized steel.
5. Attach ductwork to curb (flanges of duct rest on curb).
6. Service clearance 4 ft on each side.
7. ⇨ Direction of airflow.

UNIT 581B	SERVICE PLATE SIZES						CONNECTOR PACKAGE ACCESSORY
	"B"	"C"	"D" Alt Drain Hole	"E" Gas	"F" Power	"G" Control	
036-072	21 11/16″ [551]	16″ [406]	1¾″ [44.5]	¾″ NPT	¾″ NPT	¾″ NPT	314213-204 (Thru-the-Side)
				¾″ NPT	¾″ NPT	½″ NPT	CRBTMPWR001A00 (Thru-the-Bottom)

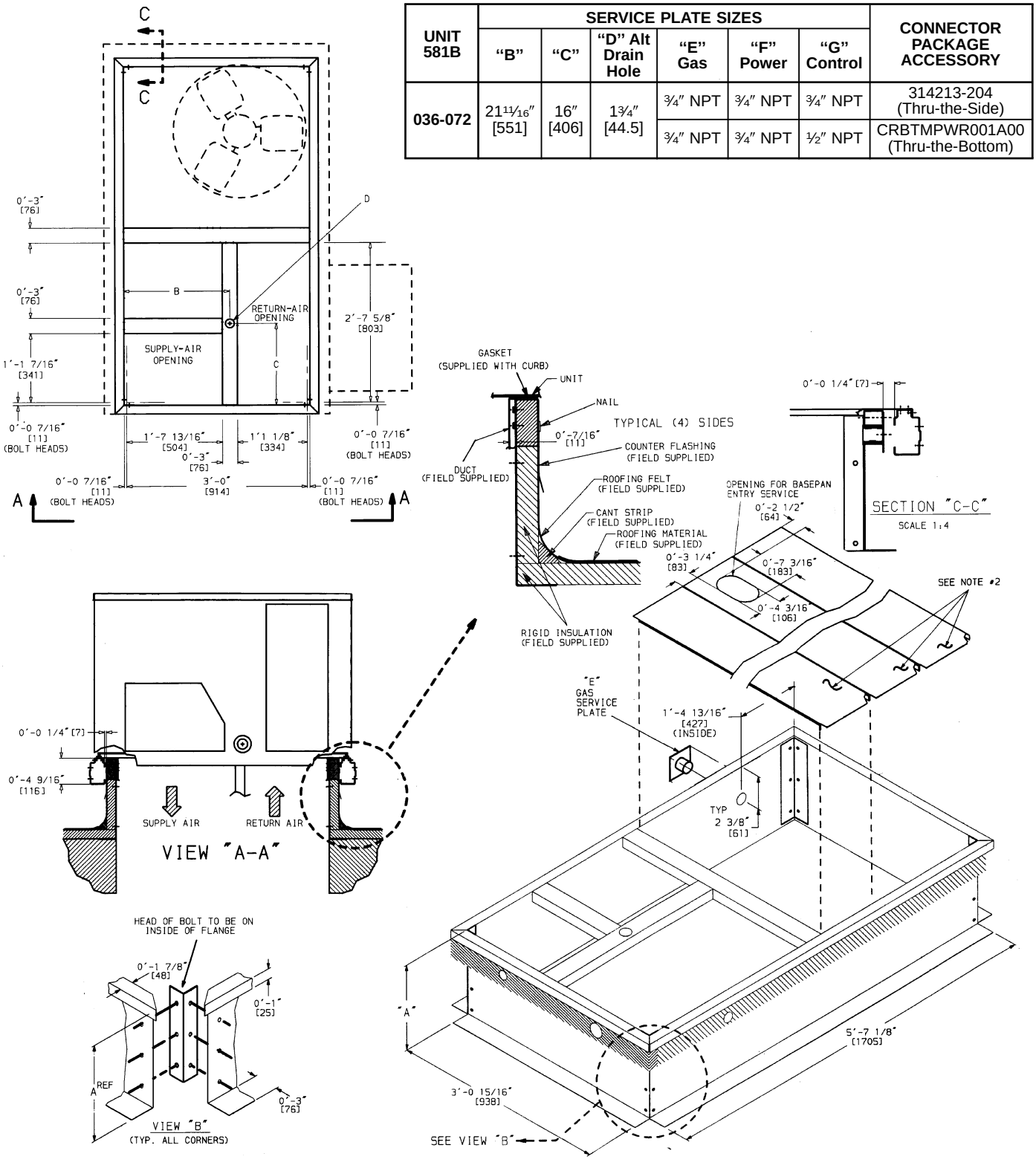
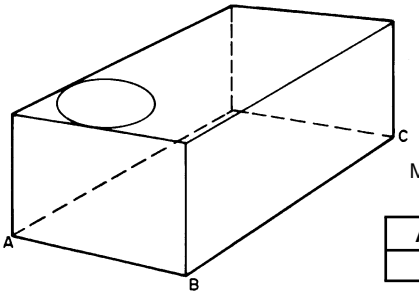


Fig. 4 — Roof Curb Dimensions



MAXIMUM ALLOWABLE DIFFERENCE (in.)

A-B	B-C	A-C
0.5	1.0	1.0

Fig. 5 — Unit Leveling Tolerances

II. UNIT DUCT CONNECTIONS

On vertical units, secure all ducts to roof curb and building structure. *Do not connect ductwork to unit.* On horizontal units, duct flanges should be attached to horizontal openings and all ductwork should be secured to flanges. Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

A minimum clearance is not required around ductwork. Cabinet return-air static shall not exceed −0.35 in. wg with Varislide™ economizer, −0.35 in. wg with PARABLADE economizer, or −0.45 in. wg without economizer.

NOTE: Connection must be made to roof curb before unit is set in place.

III. RIG AND PLACE UNIT

Inspect unit for transportation damage. File any claim with transportation agency. Keep unit upright and do not drop. Spreader bars are not required if top crating is left on unit. Rollers may be used to move unit across a roof. Level by using unit frame as a reference. See Table 1 and Fig. 6 for additional information. Operating weight is shown in Table 1 and Fig. 6.

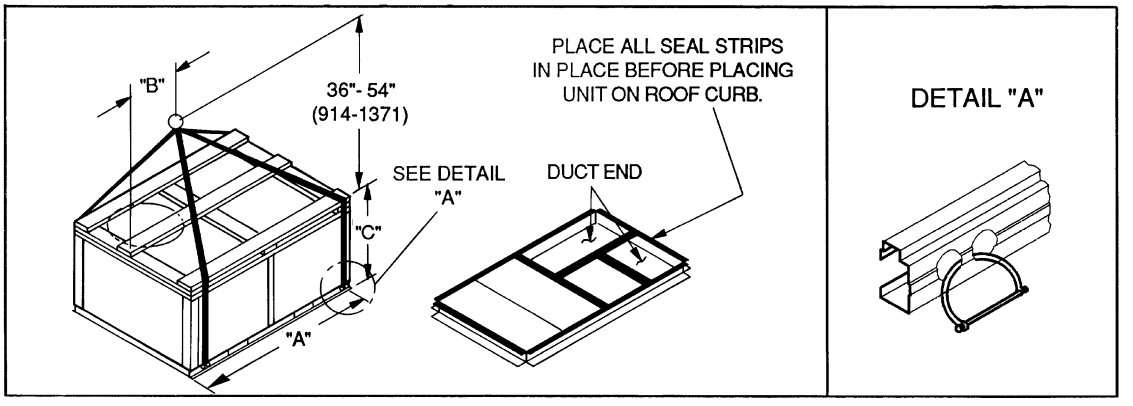
Lifting holes are provided in base rails as shown in Fig. 6. Refer to rigging instructions on unit.

IMPORTANT: If unit has forklift protection skids, be sure to remove forklift protection skids from under unit before setting unit in place.

⚠ **CAUTION:** All panels must be in place when rigging.

A properly positioned unit will have the following clearances between unit and roof curb: ¼-in. clearance between roof curb and base rails on each side and front of unit; 1 5/32-in. clearance between roof curb and rear of unit. See Fig. 4, Views A-A and C-C.

After unit is in position, remove shipping materials and rigging skids.



NOTES:
1. Dimension in ( ) are in millimeters.
2. Hook rigging shackles through holes in base rail as shown in detail "A." Holes in base rails are centered around the unit center of gravity. Use wooden top skid when rigging to prevent rigging straps from damaging unit.
3. Weights include base unit without economizer. See Table 1 for unit operating weights with an economizer.

⚠ **CAUTION:** All panels must be in place when rigging.

UNIT 581B	MAX WEIGHT		DIMENSIONS					
			"A"		"B"		"C"	
	Lb	Kg	in.	mm	in.	mm	in.	mm
036	530	240	73.69	1872	35.50	902	33.31	847
048	540	245	73.69	1872	35.50	902	33.31	847
060	560	254	73.69	1872	35.50	902	33.31	847
072	615	279	73.69	1872	35.50	902	33.31	847

Fig. 6 — Rigging Details

Table 1 — Specifications

BASE UNIT 581B	036		048			060			072		
NOMINAL CAPACITY (tons)	3		4			5			6		
OPERATING WEIGHT (lb)											
Unit	530		540			560			615		
With Economizer	564		574			594			649		
Roof Curb	115		115			115			115		
COMPRESSOR	Scroll										
Quantity	1		1			1			1		
Oil (oz)	42		53			50			60		
REFRIGERANT TYPE	R-22										
Operating Charge (lb-oz)	5-8		8-6			10.0			9-10		
CONDENSER FAN	Propeller										
Quantity...Diameter (in.)	1...22		1...22			1...22			1...22		
Nominal Cfm	3000		3000			4000			4000		
Motor Hp...Rpm	1/8...825		1/8...825			1/4...1100			1/4...1100		
Watts Input (Total)	180		180			300			300		
CONDENSER COIL	Enhanced Copper Tubes, Aluminum Lanced Fins										
Rows...Fins/in.	1...17		2...17			2...17			2...17		
Total Face Area (sq ft)	14.58		16.53			16.53			16.53		
EVAPORATOR FAN	Centrifugal										
Size (in.)	10 x 10		10 x 10			10 x 10			10 x 10		
Type Drive	Belt		Belt			Belt			Belt		
Nominal Cfm	1200		1600			2000			2400		
Maximum Continuous Bhp	1.20		1.20			1.80			2.40		
Motor Frame Size	48		48			56			56		
Fan Rpm Range	760-1090		840-1185			1020-1460			1120-1585		
Motor Bearing Type	Ball		Ball			Ball			Ball		
Maximum Fan Rpm	2100		2100			2100			2100		
Motor Pulley Pitch Diameter A/B (in.)	1.9/2.9		1.9/2.9			2.4/3.4			2.4/3.4		
Nominal Motor Shaft Diameter (in.)	1/2		1/2			1/2			5/8		
Fan Pulley Pitch Diameter (in.)	4.5		4.0			4.0			3.7		
Belt — Type...Length (in.)	A...33		A...36			A...40			A...38		
Pulley Center Line Distance (in.)	10.0-12.4		10.0-12.4			14.7-15.5			14.7-15.5		
Speed Change Per Full Turn of Movable Pulley Flange (rpm)	65		70			75			93		
Movable Pulley Maximum Full Turns from Closed Position	5		5			5			5		
Factory Setting — Full Turns Open	3		3			3			3		
Factory Speed Setting (rpm)	890		980			1240			1305		
Fan Shaft Diameter at Pulley (in.)	5/8		5/8			5/8			5/8		
EVAPORATOR COIL	Enhanced Copper Tubes, Aluminum Double Wavy Fins, Acutrol™ Feed Device										
Rows...Fins/in.	2...15		2...15			4...15			4...15		
Total Face Area (sq ft)	5.5		5.5			5.5			5.5		
FURNACE SECTION	Medium Heat	High Heat	Low Heat	Medium Heat	High Heat	Low Heat	Medium Heat	High Heat	Low Heat	Medium Heat	High Heat
Rollout Switch Cutout Temp (F)*	195	195	195	195	195	195	195	195	195	195	195
Burner Orifice Diameter (in. ...drill size)†											
Natural Gas — Std	.113...33	.113...33	.113...33	.113...33	.129...30	.113...33	.113...33	.129...30	.113...33	.113...33	.129...30
Liquid Propane — Alt**	.089...43	.089...43	.089...43	.089...43	.102...38	.089...43	.089...43	.102...38	.089...43	.089...43	.102...38
Thermostat Heat Anticipator Setting (amps) 208/230/460 v											
Stage 1	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
Stage 2	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
Gas Input (Btuh)											
Stage 1	50,000	82,000	50,000	82,000	120,000	50,000	82,000	120,000	50,000	82,000	120,000
Stage 2	72,000	115,000	72,000	115,000	150,000	72,000	115,000	150,000	72,000	115,000	150,000
Efficiency (Steady State) (%)	82	80	82	81	80	82	81	80	82	81	80
Temperature Rise Range (F)	15-45	55-85	15-45	35-65	50-80	15-45	35-65	50-80	15-45	35-65	50-80
Manifold Pressure (in. wg)											
Natural Gas (Std)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Liquid Propane (Alt)**	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Maximum Static Pressure (in. wg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Gas Valve Quantity	1	1	1	1	1	1	1	1	1	1	1
Field Gas Connection Size (in.)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
HIGH-PRESSURE SWITCH (psig)											
Standard Compressor Internal Relief	450										
Cutout	428										
Reset (Auto.)	320										
LOSS-OF-CHARGE/LOW-PRESSURE SWITCH (Liquid Line) (psig)											
Cutout	7 ± 3										
Reset (Auto.)	22 ± 5										
FREEZE-PROTECTION THERMOSTAT											
Opens (F)	30 ± 5										
Closes (F)	45 ± 5										
OUTDOOR-AIR INLET SCREENS	Cleanable										
Quantity...Size (in.)	1...20 x 24 x 1										
RETURN-AIR FILTERS	Throwaway										
Quantity...Size (in.)	2...16 x 25 x 2										

LEGEND

Bhp — Brake Horsepower

*Indicates automatic reset.
†581B036072-072072 units have 2 burners.
581B036115-072115 and 581B048150-072150 units have 3 burners.
**Indicates an accessory.

IV. FIELD CONNECTIONS

A. External Trap Condensate Drain

The unit's ¾-in. condensate drain connections are located at the bottom and side of the unit. Unit discharge connections do not determine the use of drain connections; either drain connection can be used with vertical or horizontal applications.

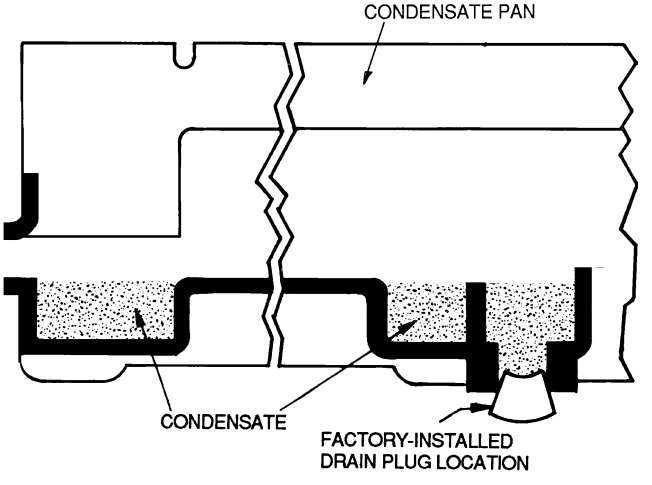
When using the standard side drain connection, make sure the plug in the alternate bottom connection is tight before installing the unit.

To use the bottom drain connection for a roof curb installation, relocate the factory-installed plug from the bottom connection to the side connection. See Fig. 7. The piping for the condensate drain and external trap can be completed after the unit is in place.

All units must have an external trap for condensate drainage. Install a trap at least 4-in. deep and protect against freeze-up. See Fig. 8. If drain line is installed downstream from the external trap, pitch the line away from the unit at 1 in. per 10 ft of run. Do not use a pipe size smaller than the unit connection.

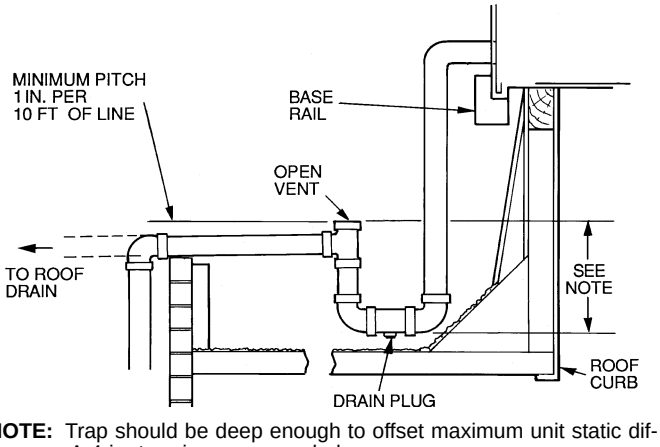
B. Install Flue Hood

Flue hood is shipped screwed to the burner compartment access panel. Remove from shipping location and using screws provided, install flue hood in location shown in Fig. 2 and 9.



NOTE: Drain plug is shown in factory-installed position.

Fig. 7 — Condensate Drain Pan



NOTE: Trap should be deep enough to offset maximum unit static difference. A 4-in. trap is recommended.

Fig. 8 — External Trap Condensate Drain

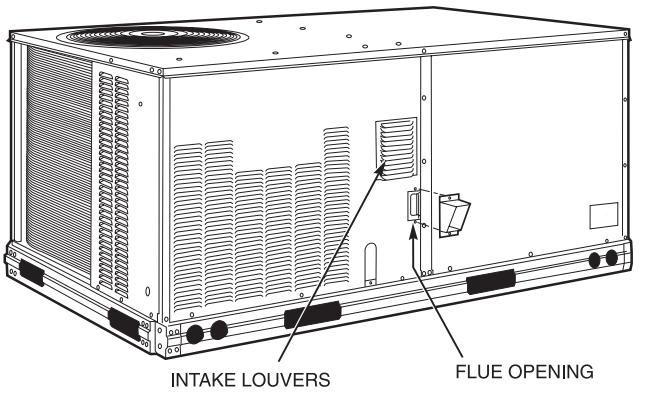


Fig. 9 — Flue Hood Details

For units being installed in California Air Quality Management Districts which require NO_x emissions of 40 nanograms/joule or less, kit CRLOWNOX001A00 must be installed.

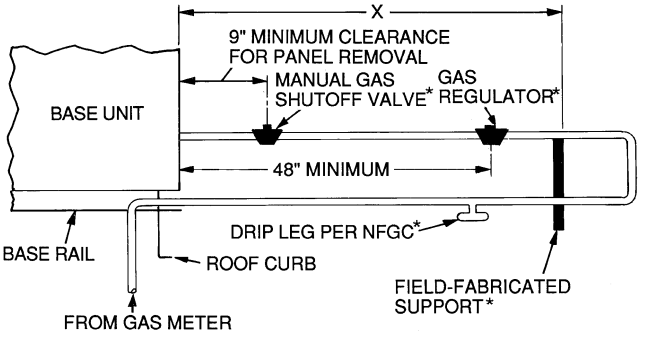
C. Gas Piping (Fig. 10)

Unit is equipped for use with type of gas shown on nameplate.

The gas supply pipe enters the unit through the access hole provided. The gas connection to the unit is made to the ½-in. female NPT gas inlet on the manual shutoff or gas valve.

Install a separate gas supply line that runs directly from the meter to the heating section. Refer to Table 2 and the NFGC for gas pipe sizing. *Do not use cast iron pipe.* Check the local utility for recommendations concerning existing lines. Choose a supply pipe that is large enough to keep the pressure loss as low as practical. *Never use pipe smaller than the ½-in. female NPT gas inlet on the unit gas valve.*

For natural gas applications, the gas pressure at unit gas connection must not be less than 4 in. wg or greater than 13 in. wg while the unit is operating. On 581B048,060,072 high heat units, the gas pressure at unit gas connection must not be less than 5 in. wg or greater than 13 in. wg while the unit is operating. For propane applications, the gas pressure must not be less than 5 in. wg or greater than 13 in. wg at the unit connection.



LEGEND

NFGC — National Fuel Gas Code

*Field Supplied.

NOTE: Follow all local codes.

STEEL PIPE NOMINAL DIAMETER (in.)	SPACING OF SUPPORTS X DIMENSION (ft)
½	6
¾ or 1	8
1¼ or Larger	10

Fig. 10 — Gas Piping Guide (With Accessory Utility Connections Package)

Table 2 — Maximum Gas Flow Capacity of Pipe in Cubic Ft of Gas Per Hour for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of 0.5 in. wg (Based on a 0.60 Specific Gravity Gas)

NOMINAL IRON PIPE SIZE (in.)	INTERNAL DIAMETER (in.)	LENGTH OF PIPE, FT*													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
½	.622	175	120	97	82	73	66	61	57	53	50	44	40	—	—
¾	.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1¼	1.380	1400	950	770	600	580	530	490	460	430	400	360	325	300	280
1½	1.610	2100	1460	1180	990	900	810	750	690	650	620	550	500	460	430

Refer to Table 10-2, National Fire Protection Association (NFPA), latest edition.

*This length includes an ordinary number of fittings.

NOTE: Typical natural gas heating value is 1000 Btuh per cubic ft.

For example: A 115,000 Btuh input unit equals 115 cubic ft per hour or $\frac{115{,}000}{1{,}000}$ = 115 cubic ft/hr.

When installing the gas supply line, observe local codes pertaining to gas pipe installations. Refer to the NFGC ANSI Z223.1-1992 (in Canada, CAN/CGA B149.1, [2]-M86) or NFPA 54-1992, in the absence of local building codes. Adhere to the following pertinent recommendations:

1. Avoid low spots in long runs of pipe. Grade all pipe ¼ inch in every 15 ft to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.
2. Protect all segments of piping system against physical and thermal damage. Support all piping with appropriate straps, hangers, etc. Use a minimum of one hanger every 6 ft. See Fig. 10. For pipe sizes larger than ½ in., follow recommendations of national codes.
3. Apply joint compound (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. *Never use Teflon-coated tape.*
4. Install sediment trap in riser leading to heating section. This drip leg functions as a trap for dirt and condensate. Install trap where condensate can not freeze. Install this sediment trap by connecting a piping tee to riser leading to heating section, so that straight-through section of tee is vertical. See Fig. 11. Then, connect capped nipple into lower end of tee. Extend capped nipple below level of gas controls.
5. Install an accessible, external, manual main shut-off valve in gas supply pipe within 6 ft of heating section.
6. Install ground-joint union close to heating section between unit manual shutoff and external manual main shut-off valve.
7. Pressure-test all gas piping in accordance with local and national plumbing and gas codes before connecting piping to unit.

NOTE: When pressure testing the gas supply system *after* the gas supply piping has been connected to the unit gas valve, the supply piping must be disconnected from the gas valve during any pressure testing of the piping systems at test pressure in excess of 0.5 psig. When pressure testing the gas supply piping system at test pressures equal to or less than 0.5 psig, the unit heating section must be isolated from the gas piping system by closing the external main manual shut-off valve and slightly opening the ground-joint union. After pressure test is completed, retighten ground-joint union.

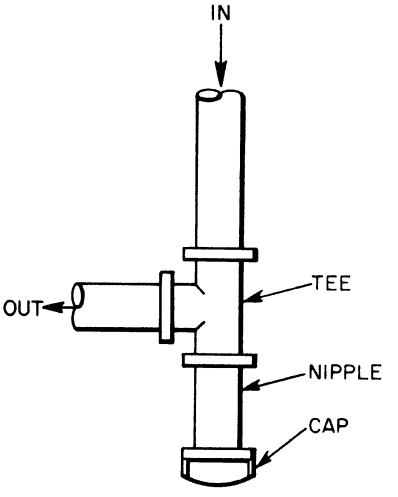


Fig. 11 — Sediment Trap

⚠ **CAUTION:** Unstable operation may occur when the gas valve and manifold assembly are forced out of position while connecting improperly routed rigid gas piping to the gas valve. Use a backup wrench when making connection to avoid strain on, or distortion of, the gas control piping.

⚠ **CAUTION:** If a flexible conductor is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 9 in. outside the unit casing.

⚠ **WARNING:** Never use a match or other open flame when checking for gas leaks. Never purge gas line into combustion chamber. Failure to adhere to this warning could result in an explosion causing personal injury or death.

8. Check for gas leaks at all field- and factory-installed gas lines after all piping connections have been completed. Use soap-and-water solution (or method specified by local codes and/or regulations).

Liquid Propane

Units are shipped for use with natural gas, but may be field-converted for use with liquid propane with accessory LP (liquid propane) kit.

All LP gas equipment must conform to NFPA safety standards.

LP gas pressure at the unit must not be less than 5 in. wg or greater than 13 in. wg under full load. Maintaining proper gas pressure depends on:

1. Vaporization rate. (Vaporization rate is determined by the temperature of the LP and the level of LP in the tank.)
2. Proper pressure regulation. (Two-stage regulation is more cost effective and efficient.)
3. Pressure drop in lines between regulators and between the second-stage regulator and the appliance. Pipe size is determined by the length of the pipe run and the total load of all appliances.

Contact your LP gas supplier or regulator manufacturer for further details regarding tank sizing, recommended regulator settings, and pipe sizing.

Special pipe compound must be used when assembling piping for liquid propane gas as white lead or commercial compounds will be easily dissolved. Use a shellac-based compound suitable for use with LP.

D. Field Duct Connections

NOTE: The design and installation of the duct system must be in accordance with the standards of the NFPA for the installation of nonresidence-type air-conditioning and ventilating systems, NFPA No. 90A or residence-type, NFPA No. 90B; and/or local codes and ordinances.

Adhere to the following criteria when selecting, sizing, and installing the duct system:

1. Remove appropriate panels from unit to obtain either a horizontal or vertical application. If units are installed for horizontal applications, remove vertical duct covers, save screws, and install covers on vertical duct openings.
2. Select and size ductwork, supply-air registers, and return-air grilles according to ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) recommendations.

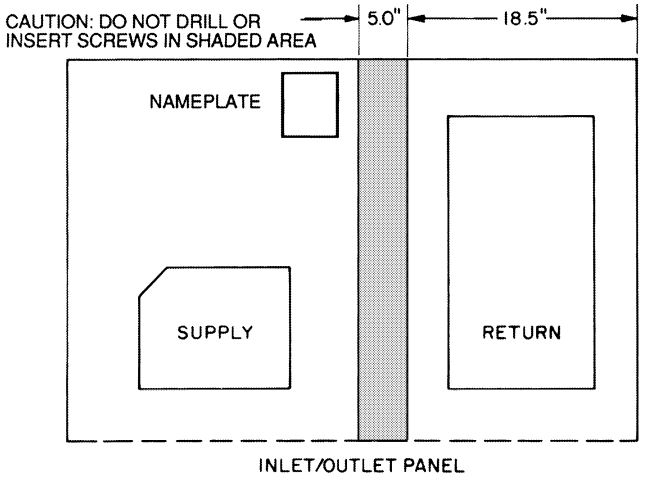


Fig. 12 — Location of Coil Area Not To Be Drilled

⚠ **CAUTION:** When the duct system fastening holes are being drilled into the side of the unit for duct flanges, be careful not to puncture the coil or coil tubes. See Fig. 12.

3. Use flexible transition between rigid ductwork and unit to prevent transmission of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure weather- and airtight seal.
4. When horizontal return is used, install external, field-supplied air filters in return-air ductwork where they are easily accessible for service. Recommended filter sizes are shown in Table 1.
5. For horizontal applications, be sure ductwork does not cover nameplate.
6. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases.
7. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing through unconditioned space, and use vapor barrier in accordance with latest issue of SMACNA (Sheet Metal and Air Conditioning Contractors National Association) and ACCA (Air Conditioning Contractors of America) minimum installation standards for heating and air-conditioning systems. Secure all ducts to building structure.
8. Flash, weatherproof, and vibration isolate all openings in building structure in accordance with local codes and good building practices.

E. Electrical Connections

⚠ **WARNING:** The unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to the unit ground lug in the control compartment or conduit approved for electrical ground when installed in accordance with the NEC (National Electrical Code); ANSI/NFPA, latest edition, (in Canada, Canadian Electrical Code CSA [Canadian Standards Association] C22.1); and local electrical codes. *Do not use gas piping as an electrical ground.* Failure to adhere to this warning could result in personal injury.

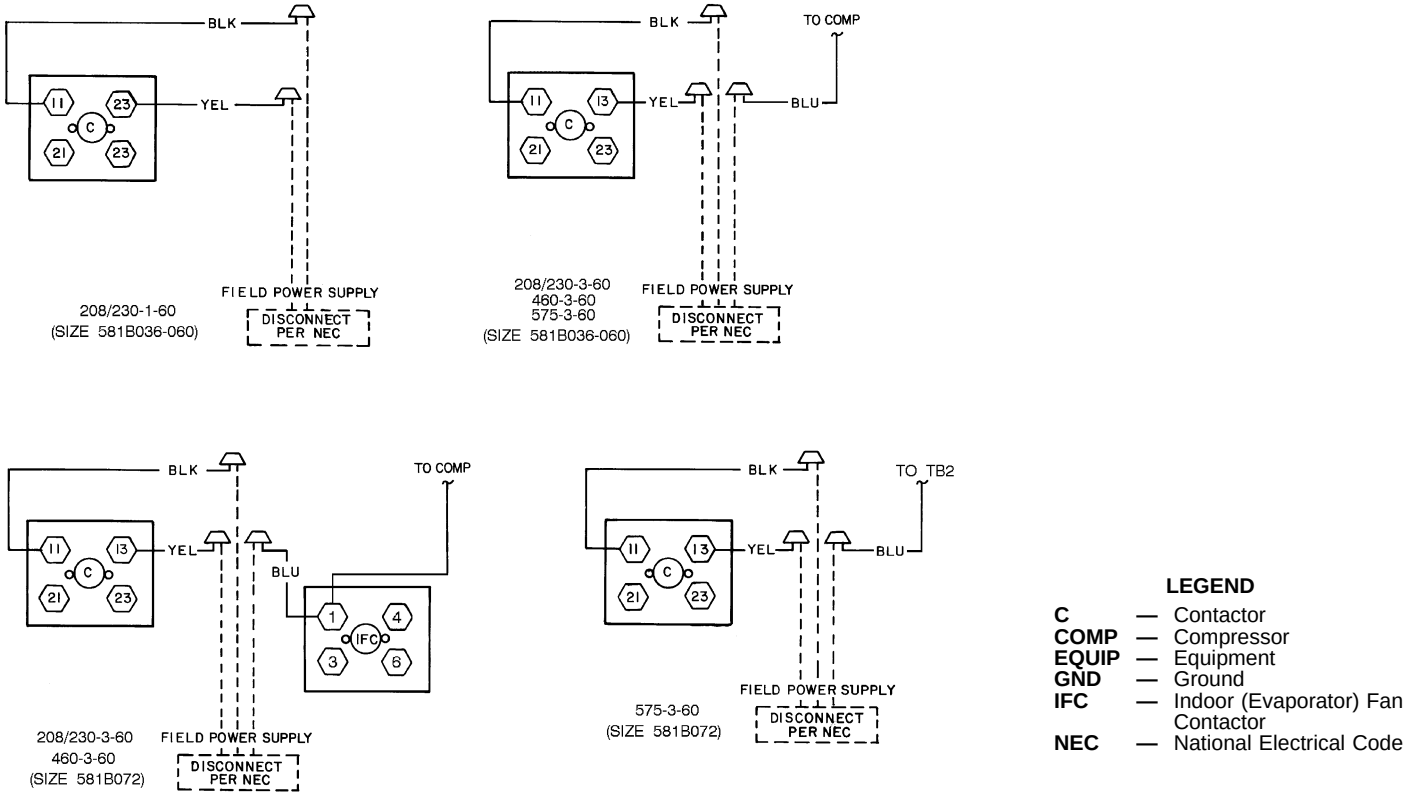
⚠ **CAUTION:** Failure to follow these precautions could result in damage to the unit being installed:

Field Power Supply (Fig. 13-15)

1. Make all electrical connections in accordance with NEC ANSI/NFPA, latest edition, and local electrical codes governing such wiring. In Canada, all electrical connections must be in accordance with CSA standard C22.1 Canadian Electrical Code Part 1 and applicable local codes. Refer to unit wiring diagram.
2. Use only *copper* conductor for connections between field-supplied electrical disconnect switch and unit. DO NOT USE ALUMINUM WIRE. Maximum wire size is no. 2 AWG (American Wire Gage).

3. Voltage to compressor terminals during operation must be within voltage range indicated on unit nameplate (also see Tables 3A and 3B). On 3-phase units, voltages between phases must be balanced within 2% and the current within 10%. Use the formula shown in Tables 3A and 3B, Note 2, to determine the percent voltage imbalance. Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation would invalidate any applicable warranty.
4. Insulate low-voltage wires for highest voltage contained within conduit when low-voltage control wires are run in same conduit as high-voltage wires.
5. Do not damage internal components when drilling through any panel to mount electrical hardware, conduit, etc.

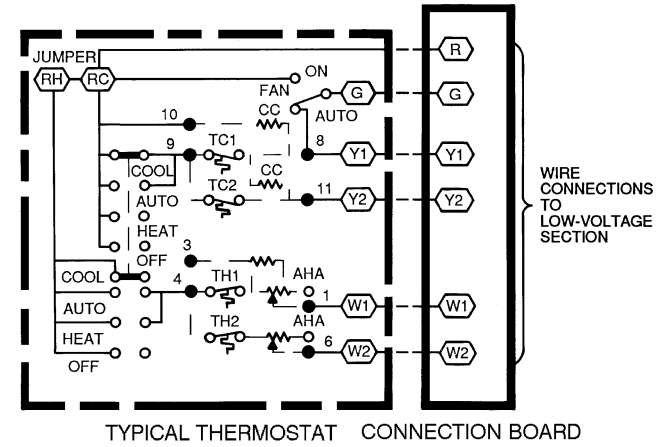
NOTE: If accessory thru-the-bottom connections and roof curbs are used, refer the Thru-the-Bottom Installation Instructions for information on power wiring.



LEGEND

C	—	Contactor
COMP	—	Compressor
EQUIP	—	Equipment
GND	—	Ground
IFC	—	Indoor (Evaporator) Fan Contactor
NEC	—	National Electrical Code

Fig. 13 — Power Wiring Connections



TYPICAL THERMOSTAT CONNECTION BOARD

LEGEND

AHA	—	Adjustable Heat Anticipator	
CC	—	Cooling Compensator	
RC	—	24-v Cooling	
RH	—	24-v Heating	
TC	—	Thermostat-Cooling	
TH	—	Thermostat-Heating	
———		Field Wiring	
- - - -		Factory Wiring	

NOTE: Connect Y2 when unit is equipped with an integrated economizer.

Fig. 14 — Low-Voltage Connections With or Without Economizer or Two-Position Damper

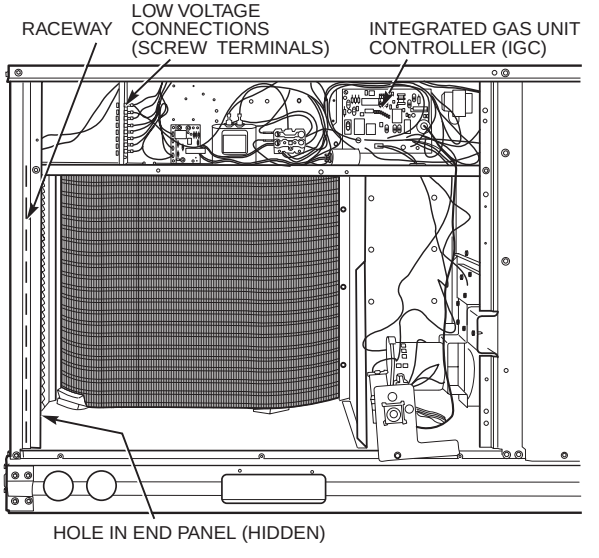


Fig. 15 — Field-Control Wiring Raceway

High-Voltage Connections (Fig. 13)

The unit must have a separate electrical service with a field-supplied, waterproof, fused disconnect switch mounted at, or within sight from the unit. Refer to the unit rating plate for maximum fuse/circuit breaker size and minimum circuit amps (ampacity) for wire sizing.

The field-supplied disconnect switch box may be mounted on the unit over the high-voltage inlet hole in the control corner panel.

Proceed as follows to complete the high-voltage connections to the unit:

1. Connect ground lead to chassis ground connection when using separate ground wire.
2. Pigtails are provided for field power connection. Use factory-supplied splices or UL (Underwriters' Laboratories) approved copper connector. Install conduit connectors in side panel power supply knockout openings indicated in Fig. 2. Route power lines through connector to unit control box.

Special Procedures for 208-V Operation

⚠DANGER: Make sure that the power supply to the unit is switched OFF before making any wiring changes. Electrical shock can cause personal injury or death.

For operation on 208 v, disconnect the black wire from the 230-v orange wire on the transformer and connect it to the 200-v red wire from the transformer. Insulate the end of the orange wire.

Table 3A — Electrical Data (Units Without Electrical Convenience Outlet)

UNIT 581B	NOMINAL VOLTAGE (V-Ph-Hz)	VOLTAGE RANGE		COMPRESSOR		OFM	IFM	COMBUSTION FAN MOTOR	POWER SUPPLY		MINIMUM UNIT DISCONNECT SIZE*	
		Min	Max	RLA	LRA	FLA	FLA	FLA	MCA	MOCP†	FLA	LRA
036 (3 Tons)	208/230-1-60	187	254	16.0	88.0	0.7	4.9	.57	25.6/25.6	35/35	25/25	101/101
	208/230-3-60	187	254	10.3	77.0	0.7	4.9	.57	18.5/18.5	25/25	18/18	90/ 90
	460-3-60	414	508	5.1	39.0	0.4	2.2	.30	9.0	15	9	46
	575-3-60	518	632	4.2	31.0	0.4	2.2	.30	7.3	15	7	37
048 (4 Tons)	208/230-1-60	187	254	23.7	129.0	0.7	4.9	.57	35.2/35.2	45/45	34/34	142/142
	208/230-3-60	187	254	13.5	99.0	0.7	4.9	.57	22.5/22.5	30/30	22/22	112/112
	460-3-60	414	508	7.4	49.5	0.4	2.2	.30	9.7	15	12	57
	575-3-60	518	632	5.8	40.0	0.4	2.2	.30	9.3	15	9	46
060 (5 Tons)	208/230-1-60	187	254	28.8	169.0	1.5	8.8	.57	46.3/46.3	60/60	45/45	216/216
	208/230-3-60	187	254	17.3	123.0	1.5	5.8	.57	29.0/29.0	35/35	28/28	168/168
	460-3-60	414	508	9.0	62.0	0.8	2.6	.30	14.7	20	14	84
	575-3-60	518	632	7.1	50.0	0.8	2.6	.30	11.6	15	11	59
072 (6 Tons)	208/230-3-60	187	254	20.5	156.0	1.4	5.8	.57	32.8/32.8	40/40	32/32	200/200
	460-3-60	414	508	9.6	70.0	0.6	2.6	.30	15.2	20	15	92
	575-3-60	518	632	7.7	56.0	0.6	2.6	.30	12.2	15	12	74

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps
UL — Underwriters' Laboratories

*Used to determine minimum disconnect per NEC.
†Fuse or HACR circuit breaker.

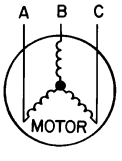
NOTES:

1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The CUL units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**

   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

EXAMPLE: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v
Maximum deviation is 7 v.

Determine percentage of voltage imbalance:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

3. 575-v units are UL, Canada approved only.

Table 3B — Electrical Data (Units with Electrical Convenience Outlet)

UNIT 581B	NOMINAL VOLTAGE (V-Ph-Hz)	VOLTAGE RANGE		COMPRESSOR		OFM	IFM	COMBUSTION FAN MOTOR	POWER SUPPLY WITH OUTLET		MINIMUM UNIT DISCONNECT SIZE*	
		Min	Max	RLA	LRA	FLA	FLA	FLA	MCA	MOCP†	FLA	LRA
036 (3 Tons)	208/230-1-60	187	254	16.0	88.0	0.7	4.9	.57	31.6/31.66	40/40	30/30	106/106
	208/230-3-60	187	254	10.3	77.0	0.7	4.9	.57	24.5/24.5	30/30	24/24	95/ 95
	460-3-60	414	508	5.1	39.0	0.4	2.2	.30	14.6	20	14	59
	575-3-60	518	632	4.2	31.0	0.4	2.2	.30	11.5	15	11	47
048 (4 Tons)	208/230-1-60	187	254	23.7	129.0	0.7	4.9	.57	41.2/41.2	50/50	39/39	147/147
	208/230-3-60	187	254	13.5	99.0	0.7	4.9	.57	28.5/28.5	35/35	28/28	117/117
	460-3-60	414	508	7.4	49.5	0.4	2.2	.30	14.6	20	14	59
	575-3-60	518	632	5.8	40.0	0.4	2.2	.30	11.5	15	11	47
060 (5 Tons)	208/230-1-60	187	254	28.8	169.0	1.5	8.8	.57	52.3/52.3	60/60	51/51	221/221
	208/230-3-60	187	254	17.3	123.0	1.5	5.8	.57	34.9/34.9	40/40	34/34	173/173
	460-3-60	414	508	9.0	62.0	0.8	2.6	.30	17.4	20	17	87
	575-3-60	518	632	7.1	50.0	0.8	2.6	.30	13.8	20	13	61
072 (6 Tons)	208/230-3-60	187	254	20.5	156.0	1.4	5.8	.57	38.8/38.8	45/45	35/35	205/205
	460-3-60	414	508	9.6	70.0	0.6	2.6	.30	17.9	20	17	95
	575-3-60	518	632	7.7	56.0	0.6	2.6	.30	14.4	20	14	75

LEGEND

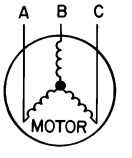
CUL — Canadian Underwriters' Laboratories
FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
NEC — National Electrical Code
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

*Used to determine minimum disconnect per NEC.
†Fuse or HACR circuit breaker.

NOTES:
1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. The CUL units may be fuse or circuit breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

EXAMPLE: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{452 + 464 + 455}{3} = \frac{1371}{3} = 457$$

Determine maximum deviation from average voltage.
(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v
Maximum deviation is 7 v.

Determine percentage of voltage imbalance:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457} = 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

3. 575-v units are CUL approved only.

Control Voltage Connections

Install a factory-approved room thermostat. See Table 4. Locate the thermostat on an inside wall in the space to be conditioned where it will not be subjected to either a cooling or heating source or direct exposure to sunlight. Mount the thermostat 4 to 5 ft above the floor.

Route thermostat cable or equivalent single leads of colored wire from subbase terminals through connector on unit to low-voltage connections (shown in Fig. 14).

Connect thermostat wires to matching screw terminals of low-voltage connection board. See Fig. 14.

NOTE: For wire runs up to 50 ft, use no. 18 AWG insulated wire (35 C minimum). For 50 to 75 ft, use no. 16 AWG insulated wire (35 C minimum). For 75 to 155 ft, use no. 14 AWG insulated wire (35 C minimum). All wire larger than no. 18 AWG cannot be directly connected to the thermostat and will require a junction box and splice at the thermostat.

Pass control wires through the hole provided in the corner post; then feed wires through the raceway built into the corner post to the 24-v barrier located on the left side of the control box. See Fig. 15. The raceway provides the UL required clearance between high- and low-voltage wiring.

Connect thermostat wires to pigtails of low-voltage circuit in low-voltage section on control box using wirenuts.

Table 4 — Thermostat List*

TYPE
Manual Changeover (Standard) 2 Heat/2 Cool
Auto. Changeover (Standard) 2 Heat/2 Cool
Manual Changeover (Electronic Setback) 2 Heat/2 Cool
Auto. Changeover (Electronic Setback) 2 Heat/2 Cool

*See Trade Prices for part numbers.

Heat Anticipator Setting

The room thermostat heat anticipator must be properly adjusted to ensure proper heating performance. Set the heat anticipator, using an ammeter to determine the exact required setting.

NOTE: For thermostat selection purposes, use .14 amp for the approximate required setting. Set heat anticipator stage 1 and 2 at .14 amp.

Failure to make a proper heat anticipator adjustment may result in improper operation, discomfort to the occupants of the conditioned space, and inefficient energy utilization; however, the required setting may be changed slightly to provide a greater degree of comfort for a particular installation.

F. Accessory Installation

At this time any required accessories should be installed on the unit. Control wiring information is provided in the unit wiring book. Refer to accessory Installation Instructions provided with accessory.

G. Optional Varislide™ Economizer

The optional economizer hood assembly is packaged and shipped in the filter section. Damper blades and control boards are installed at the factory and the economizer is shipped in the vertical discharge position.

NOTE: Horizontal discharge block-off plate is shipped with the air hood package. If unit is to be used for vertical discharge application, discard this plate.

Assembly

1. Determine if ventilation air is required in building. If so, determine the minimum amount to be supplied by each unit and record quantity of ventilation air needed for use in Step 7.
2. Remove filter access panel by raising panel and swinging panel outward. Panel is now disengaged from track and can be removed. No tools are required to remove filter access panel. Remove outdoor-air opening panel. Save panels and screws. See Fig. 16. Remove optional outdoor-air damper hood package from filter section.
3. Assemble outdoor-air hood top and side plates as shown in Fig. 17. Install seal strips on hoop top and sides. Put aside screen retainer and retainer screw for later assembly. *Do not attach hood to unit at this time.*
4. Slide economizer into unit and secure with screws. See Fig. 18.

NOTE: Be sure to engage rear economizer flange under tabs in vertical return-air opening.

5. To convert to horizontal discharge application:
   a. Rotate the economizer 90 degrees until the economizer motor faces the condenser section (see Fig. 19.).
   b. Rotate the barometric relief damper cover 90 degrees.
   c. Install horizontal discharge block-off plate over the opening on the access panel. (Block-off plate MUST be installed before installing hood assembly.) See Fig. 20.
6. Insert economizer plug into economizer harness. Remove tape from barometric relief damper. See Fig. 21.
7. If ventilation air is not required, proceed to Step 9. If ventilation air is required, determine the minimum position setting for required airflow. See Fig. 22. Adjust minimum position setting by adjusting the screws on the position setting bracket. Slide bracket until the top screw is in the position determined by Fig. 22. Tighten screws.

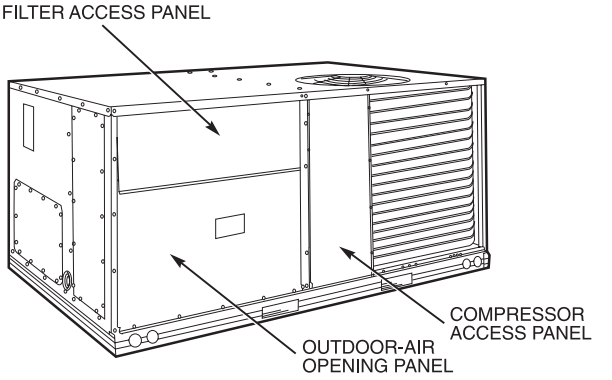
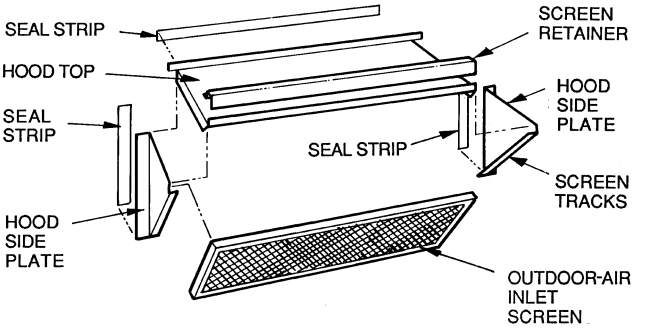
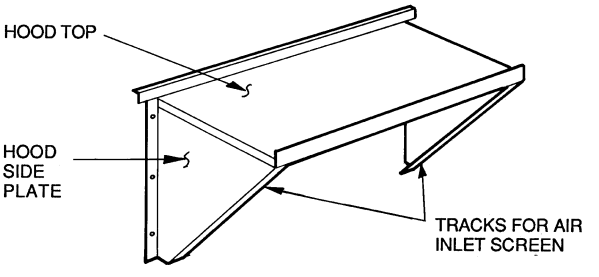


Fig. 16 — Typical Access Panel Locations



OUTDOOR – AIR HOOD – UNASSEMBLED



HOOD SIDES AND TOP – ASSEMBLED

Fig. 17 — Outdoor-Air Hood Details

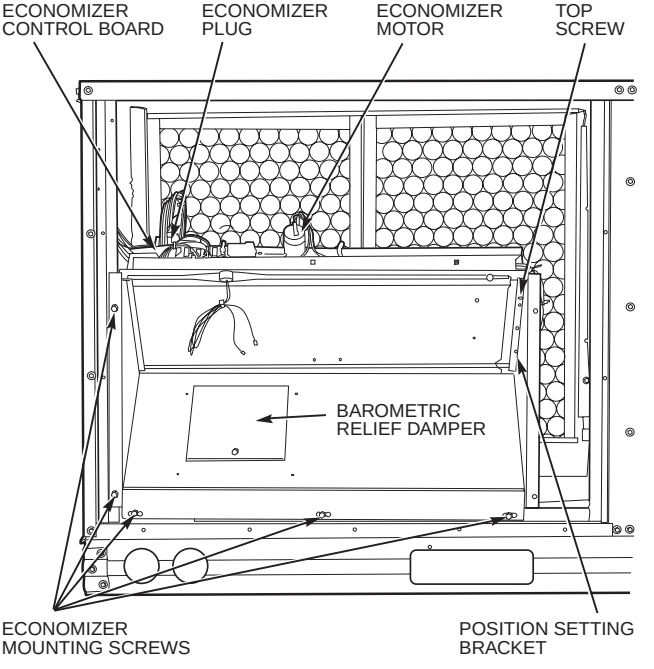


Fig. 18 — Varislide Economizer Installed in Unit

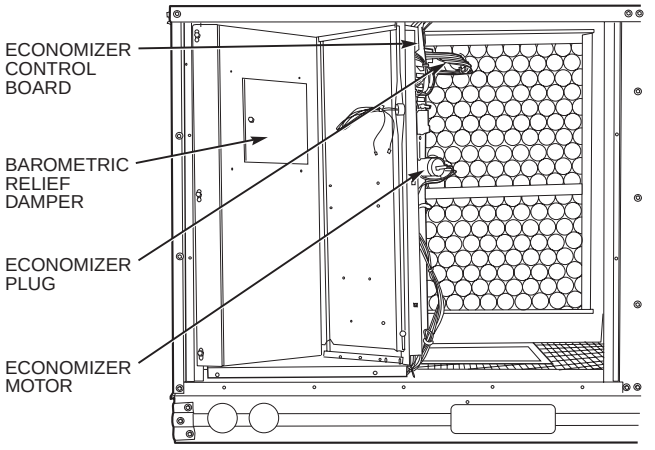
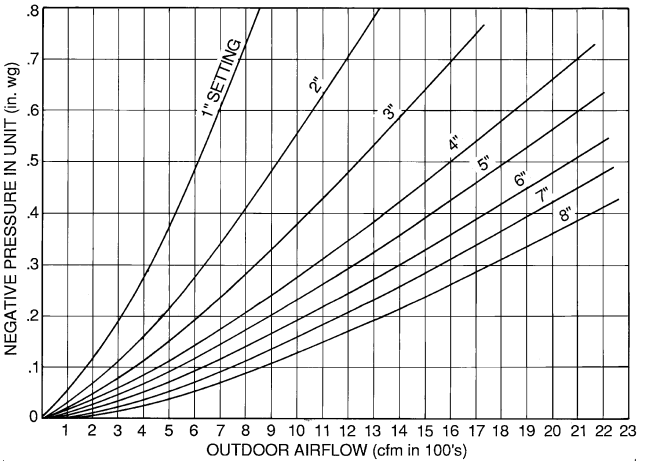


Fig. 19 — Horizontal Varislide™ Economizer Installation (90 Degree Rotation)



EXAMPLE:

Given:

Negative Pressure . . . . . 0.2 in. wg

Outdoor Air . . . . . 900 cfm

Determine — Setting — 5 in.

Fig. 22 — Varislide Economizer Minimum Position Setting

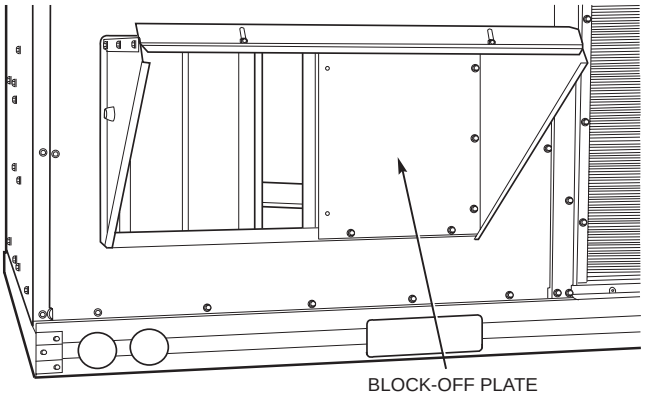


Fig. 20 — Horizontal Discharge Block-Off Plate

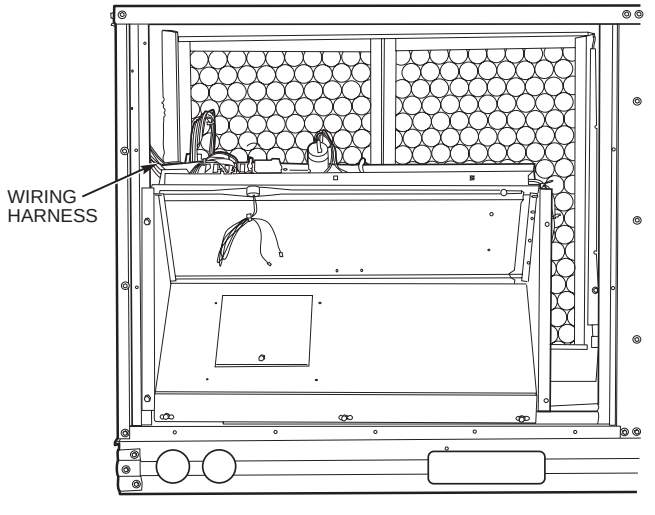


Fig. 21 — Typical Varislide Economizer and Wiring Harness

8. Remove tape from outdoor-air thermostat (OAT). Fasten OAT to inside of hood using screws and speed clips provided. See Fig. 23. Make sure OAT terminals are positioned up.
9. Replace outdoor-air opening panel using screws from Step 2. Replace filter access panel. Ensure the filter access panel slides along the tracks and is securely engaged.
10. Fasten hood top and side plate assembly (Fig. 17) to outdoor-air opening panel with screws provided.
11. Place knob supplied with economizer on OAT. See Fig. 23. Set for 3° F below indoor room thermostat setting. If accessory enthalpy control (EC) is used in place of OAT, see instructions shipped with EC for installation and adjustment. See Fig. 23.
12. Connect OAT per Fig. 24.
13. Slide outdoor-air inlet screen into screen track on hood side plate. While holding screen in place, fasten screen retainer to hood using screws provided.

NOTE: Refer to Fig. 25 for economizer barometric relief damper characteristics.

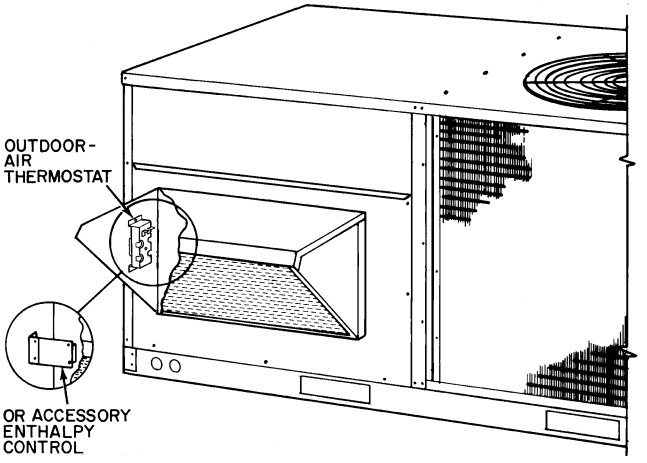
H. Optional PARABLADE Economizer

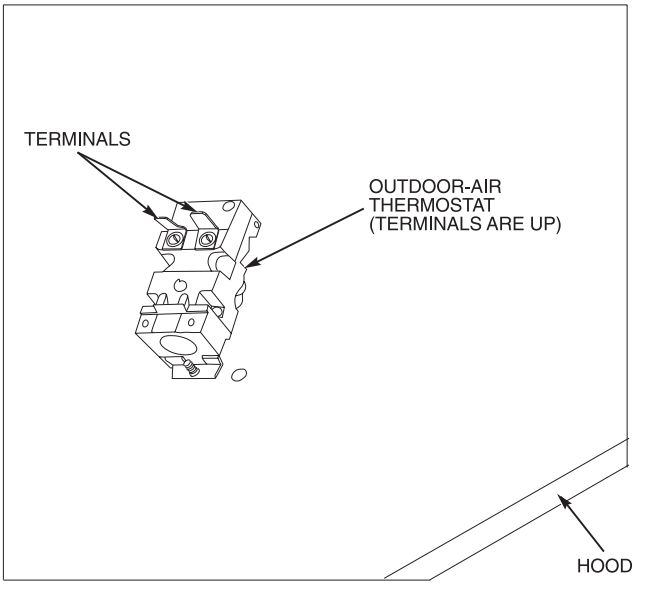
The optional PARABLADE economizer hood assembly is packaged and shipped in the filter section. Damper blades and control boards are installed at the factory and the economizer is shipped in the vertical discharge position.

NOTE: Horizontal discharge block-off plate is shipped with the air hood package. The PARABLADE economizer can only be used for vertical discharge applications. Discard this plate.

Assembly

1. Determine if ventilation air is required in building. If so, determine the minimum amount to be supplied by each unit and record quantity of ventilation air needed for use in Step 6.
2. Remove filter access panel by raising panel and swinging panel outward. Panel is now disengaged from track and can be removed. No tools are required to remove filter access panel. Remove outdoor-air opening panel.





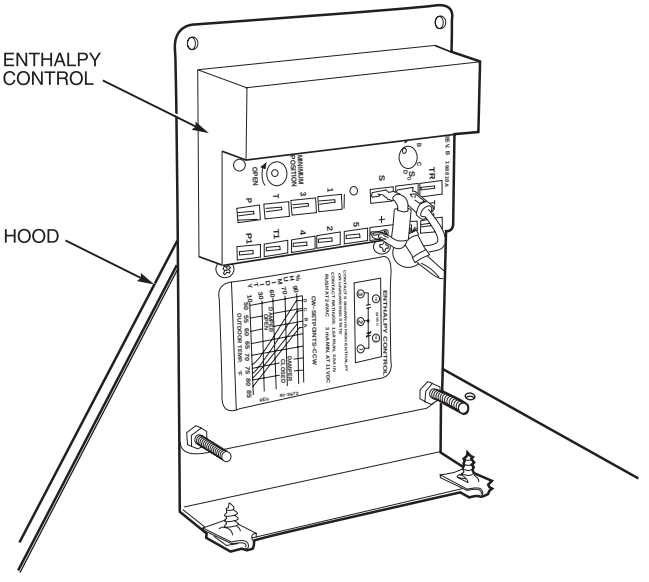
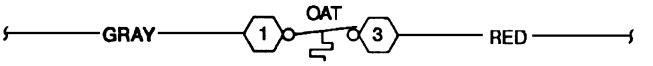


Fig. 23 — Outdoor-Air Thermostat/Enthalpy Control Installation



LEGEND

OAT — Outdoor-Air Thermostat

NOTE: See unit wiring diagram for details.

Fig. 24 — Wiring Connections for Outdoor-Air Thermostat

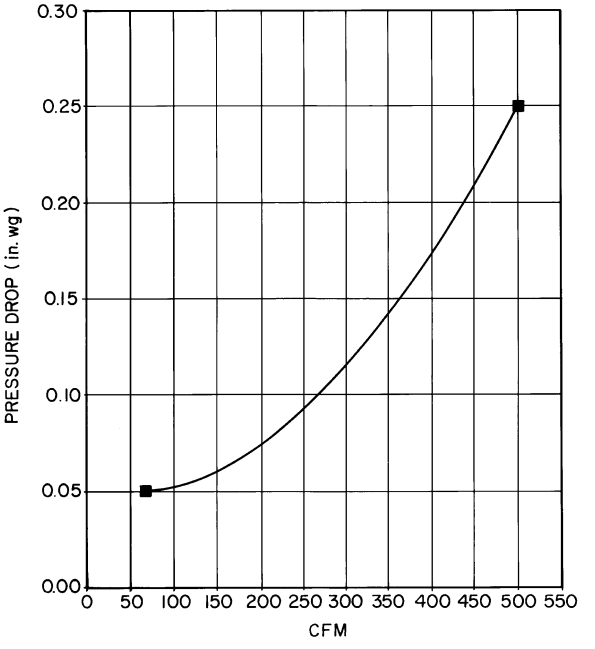


Fig. 25 — Varislide™ Economizer Barometric Relief Damper Characteristics

Save panels and screws. Remove optional economizer so the outdoor-air damper hood package can be removed from the filter section. See Fig. 16.

3. Assembly outdoor-air hood top and side plates as shown in Fig. 17. Install seal strips on hoop top and sides. Put aside screen retainer and retainer screw for later assembly. *Do not attach hood to unit at this time.*
4. Slide economizer into unit and secure with screws. See Fig. 26.

NOTE: Be sure to engage rear economizer flange under tabs in vertical return-air opening.

5. Insert economizer plug into economizer harness. Remove tape from barometric relief damper. See Fig. 26.
6. If ventilation is not required, proceed to Step 7. If ventilation air is required, perform the following:
   a. Make sure the factory-installed jumper is in place across terminals P and P1 on the economizer logic module. T and T1 should be disconnected during adjustment.
   b. The 2 potentiometers with slots for adjustment are located on the face of the economizer logic module. Turn the lower potentiometer fully clockwise. The dampers should be fully closed. Turn the potentiometer gradually counterclockwise until the desired position is reached.
   c. Connect T and T1 to the 24V power supply.

d. After installation is complete, calculate the minimum airflow across the economizer. To calculate the minimum airflow, the following data is needed: total cfm (cfm_3), temperature of the total cfm (T_3), temperature of the return air (T_2), and temperature of the entering outside air (T_1). Cfm_1 is the outside air cfm, which will be the minimum airflow.

Insert the data into the following equations:

$$\frac{T_1\,(cfm_1) + T_2\,(cfm_2)}{cfm_3} = T_3$$

$$cfm_2 = (cfm_3 - cfm_1)$$

Therefore:

$$\frac{T_1\,(cfm_1) + T_2\,(cfm_3 - cfm_1)}{cfm_3} = T_3$$

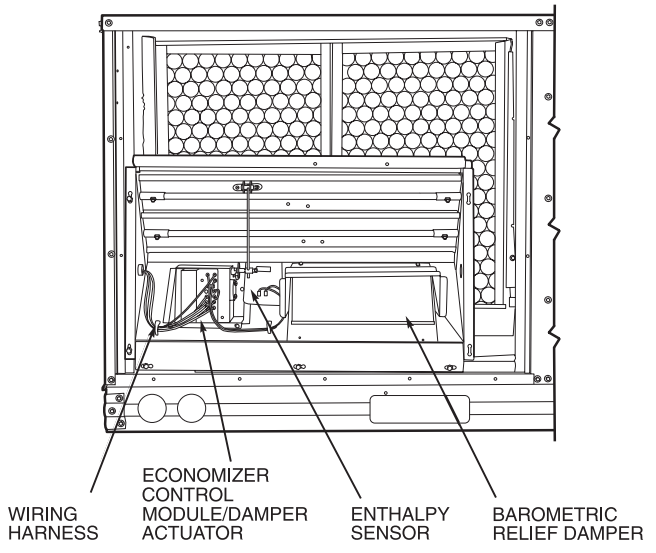


Fig. 26 — PARABLADE Economizer Installed in Unit

CONTROL CURVE	CONTROL POINT (APPOX. DEG.) AT 50% RH
A	73 (23)
B	70 (21)
C	67 (19)
D	63 (17)

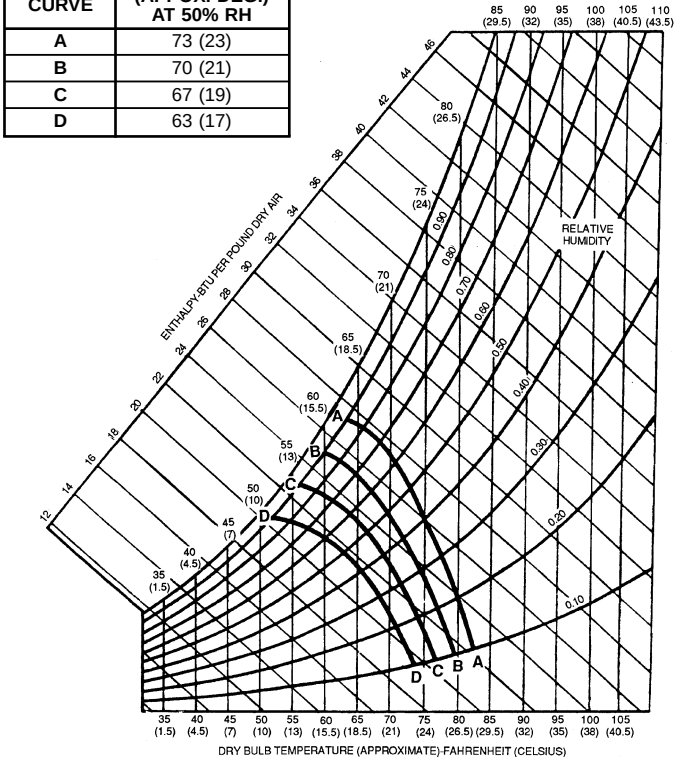


Fig. 27 — Enthalpy Settings for PARABLADE Economizer

Use this equation to determine cfm_1, which is the minimum airflow across the economizer.

$$cfm_1 = \frac{(T_3 - T_2)\,cfm_3}{(T_1 - T_2)}$$

If cfm_1 does not match the desired minimum airflow from Step 1, readjust the minimum position setting screw.

7. Determine the enthalpy changeover set point from Fig. 27. The enthalpy changeover set point should be set to return the outdoor air damper to the minimum position when enthalpy rises above the set point. The settings are A, B, C, and D. Set the enthalpy changeover per the setting in Fig. 27.
8. Replace outdoor-air opening panel using screws from Step 2. Replace filter access panel. Ensure the filter access panel slides along the tracks and is securely engaged. See Fig. 28.
9. Fasten hood top and side plate assembly (Fig. 29) to outdoor-air opening panel with screws provided.
10. Slide outdoor-air inlet screen into screen track on hood side plate. While holding screen in place, fasten screen retainer to hood using screws provided. See Fig. 30.

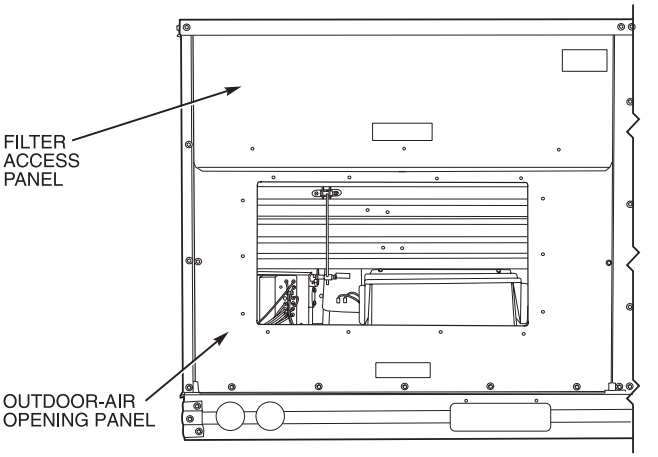


Fig. 28 — Panels Reinstalled On Unit

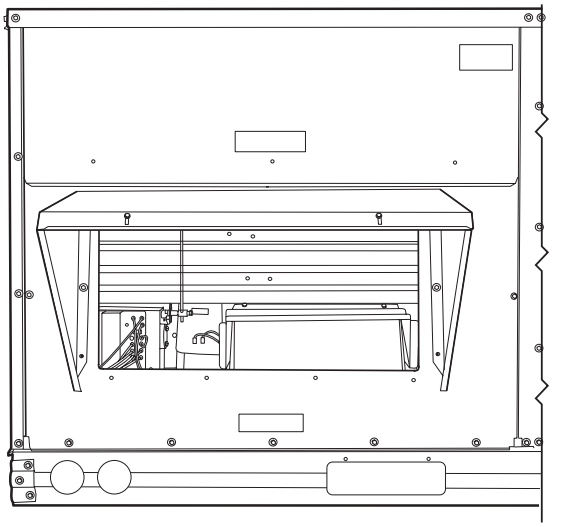


Fig. 29 — Outdoor-Air Hood Installed On Unit

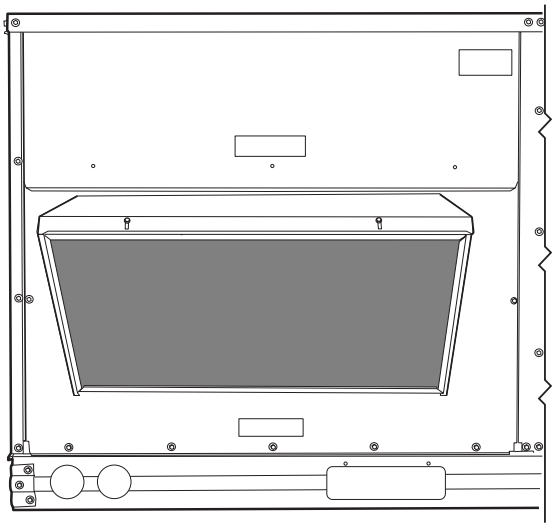


Fig. 30 — Filter Installed on Outdoor-Air Hood

PRE-START-UP

⚠ **WARNING:** Failure to observe the following warnings could result in serious personal injury:

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources have been disconnected.
4. If refrigerant leak is suspected around compressor terminals, relieve all pressure from system before touching or disturbing anything inside terminal box.
5. Never attempt to repair soldered connection while refrigerant system is under pressure.
6. Do not use torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off gas supply and *then* electrical power to unit.
   b. Reclaim refrigerant to relieve all pressure from system using both high- and low-pressure ports.
   c. Cut component-connecting tubing with tubing cutter and remove component from unit.
   d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Proceed as follows to inspect and prepare the unit for initial startup:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to, or shipped with, unit.
3. Make the following inspections:
   a. Inspect for shipping and handling damages, such as broken lines, loose parts, disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid-soap solution. If refrigerant leak is detected, see Refrigerant Leaks section on page 30.
   c. Inspect all field- and factory-wiring connections. Be sure that connections are completed and tight.
   d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:

⚠ **DANGER:** Do not purge gas supply into the combustion chamber. Do not use a match or other open flame to check for gas leaks. Failure to adhere to this warning could result in an explosion causing personal injury or death.

   a. Make sure that gas supply has been purged, and that all gas piping has been checked for leaks.
   b. Make sure that condenser-fan blade is correctly positioned in fan orifice. *Blades should clear fan motor and fan orifice ring.*
   c. Make sure that correct air filters are in place. (See Table 1.) Do not operate unit without return-air filters.
   d. Make sure that condensate drain pan and trap are filled with water to ensure proper drainage.
   e. Make sure that all tools and miscellaneous loose parts have been removed.
   f. Make sure outdoor-air inlet screen is in place.
5. Compressors are internally spring mounted. Do not loosen or remove compressor holddown bolts.
6. Each unit system has 4 Schrader-type gage ports: one on the suction line, one on the compressor discharge line, and two additional Schrader valves located under the high-pressure and low-pressure switches. Be sure that caps on the ports are tight.

Unit is now ready for initial start-up.

START-UP

I. COMPRESSOR ROTATION

On 3-phase units it is important to be certain the scroll compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Note that the evaporator fan (006 and 007 only) is probably also rotating in the wrong direction.
2. Turn off power to the unit.
3. Reverse any 2 of the unit power leads.
4. Reapply power to the compressor.

The suction and discharge pressure levels should now move to their normal start-up levels.

NOTE: When the compressor is rotating in the wrong direction, the unit will make an elevated level of noise and will not provide cooling.

II. HEATING SECTION START-UP AND ADJUSTMENTS

⚠ **CAUTION:** Complete the required procedures given in the Pre-Start-Up section on this page before starting unit.

Do not jumper any safety devices when operating the unit.

Ensure that burner orifices are properly aligned. Unstable operation may occur when the burner orifices in the manifold are misaligned.

Follow the lighting instructions on the heating section operation label (located inside the burner access door) to start the heating section.

When lighting the unit for the first time, perform the following additional steps: If the gas supply pipe was not purged before connecting the unit, it will be full of air. It is recommended that the ground joint union be loosened and the supply line be allowed to purge until the odor of gas is detected. Never purge gas lines into a combustion chamber. Immediately upon detection of gas odor, retighten the union. Allow 5 minutes to elapse, then light unit in accordance with Checking Heating Control Operation section below.

A. Checking Heating Control Operation

Start and check the unit for proper heating control operation as follows: (Also see unit lighting instructions located inside the burner access panel.)

1. Turn on unit electrical supply and manual gas valve.
2. Set system switch selector at HEAT position and fan switch at AUTO. or ON position. Set heating temperature lever above room temperature.
3. The induced-draft motor will start immediately. The evaporator fan will have a 45-second delay before starting.
4. After a call for heating, the main burners should light within 5 seconds. If the burner does not light, then there is a 22-second delay before another 5-second try. If the burner still does not light, the time delay is repeated. If the burner does not light within 15 minutes, there is a lockout. To reset the control, break the 24-v power to W1.
5. The evaporator-fan motor will turn on 45 seconds after burner ignition.
6. The evaporator-fan motor will turn off 45 seconds after thermostat temperature is satisfied.
7. Adjust airflow to obtain a temperature rise within the range specified on the unit nameplate.

NOTE: The default value for the evaporator-fan motor ON/OFF delay is 45 seconds. The Integrated Gas Unit Controller (IGC) modifies this value when abnormal limit switch cycles occur. Based upon unit operating conditions, the ON delay can be reduced to 0 seconds and the OFF delay can be extended to 180 seconds. When one flash of the light-emitting diode (LED) is observed, the evaporator-fan ON/OFF delay has been modified.

If the limit switch trips at the start of the heating cycle during the evaporator ON delay, the time period of the ON delay for the next cycle will be 5 seconds less than the time at which the switch tripped.

EXAMPLE: If the limit switch trips at 30 seconds, the evaporator-fan ON delay for the next cycle will occur at 25 seconds.

To prevent short-cycling, a 5-second reduction will only occur if a minimum of 10 minutes has elapsed since the last call for heating.

The evaporator-fan OFF delay can also be modified. Once the call for heating has ended, there is a 10 minute period during which the modification can occur. If the limit switch trips during this period, the evaporator-fan OFF delay will increase by 15 seconds. A maximum of 9 trips can occur, extending the evaporator-fan OFF delay to 180 seconds.

To restore the original default value, reset the power to the unit.

To shut off unit set system switch selector at OFF position. Resetting heating selector lever below room temperature will temporarily shut unit off until space temperature falls below thermostat setting.

B. Safety Relief

A soft solder joint at the suction service Schrader port provides pressure relief under abnormal temperature and pressure conditions.

C. Ventilation (Continuous Fan)

Set fan and system switch selectors at ON and OFF positions, respectively. Evaporator fan operates continuously to provide constant air circulation. When the evaporator-fan selector switch is turned to the OFF position, there is a 30-second delay before the fan turns off.

D. Gas Input

Check gas input and manifold pressure after unit start-up. (See Table 5.) If adjustment is required proceed as follows.

⚠ **CAUTION:** These units are designed to consume the rated gas inputs using the fixed orifices at specified manifold pressures as shown in Table 5. DO NOT REDRILL THE ORIFICES UNDER ANY CIRCUMSTANCES.

The rated gas inputs shown in Table 5 are for altitudes from sea level up to 2000 ft above sea level. These inputs are based on natural gas with a heating value of 1050 Btu/ft^3 at 0.65 specific gravity, or LP gas with a heating value of 2500 Btu/ft^3 at 1.5 specific gravity. For elevations above 2000 ft, reduce input 4% for each 1000 ft above sea level. When the gas supply being used has a different heating value or specific gravity, refer to national and local codes, or contact your distributor or branch to determine the required orifice size. Refer to Table 6 for the correct orifice to use at high altitudes. Kits are available from your distributor.

E. Adjusting Gas Input

The gas input to the unit is determined by measuring the gas flow at the meter or by measuring the manifold pressure. Measuring the gas flow at the meter is recommended for natural gas units. The manifold pressure must be measured to determine the input of propane gas units.

Measuring Gas Flow at Meter Method — Natural Gas Units

Minor adjustment can be made by changing the manifold pressure. The manifold pressure must be maintained between 3.2 and 3.8 in. wg on high-fire, two-stage units. If larger adjustments are required, change main burner orifices following the recommendations of national and local codes.

NOTE: All other appliances that use the same meter must be turned off when gas flow is measured at the meter.

Proceed as follows:

1. Turn off gas supply to unit.
2. Remove pipe plug on outlet of gas valve or manifold, then connect manometer at this point. Turn on gas to unit.

Table 5 — Rated Gas Inputs at Indicated Manifold Pressures

UNIT 581B	NUMBER OF ORIFICES	GAS SUPPLY PRESSURE (in. wg)				MANIFOLD PRESSURE (in. wg)		NATURAL GAS		PROPANE*	
		Natural		Propane				Orifice Drill Size	Heating Input (Btuh)†	Orifice Drill Size	Heating Input (Btuh)†
		Min	Max	Min	Max	Natural	Propane				
036-072**	2	4.0	13.6	5.0	13.0	3.5	3.5	33	72,000	43	72,000
	3	4.0	13.6	5.0	13.0	3.5††	3.5††	33	115,000††	43	115,000††
	3	5.0	13.6	5.0	13.0	3.5‖	3.5‖	30	150,000‖	38	150,000‖

*When a 581B unit is converted to liquid propane (LP), the burners must be modified with accessory LP Kit.
†Based on altitudes from sea level up to 2000 ft above sea level. For altitudes above 2000 ft, reduce input rating 4% for each 1000 ft above sea level. In Canada, from 2000 ft above sea level to 4,500 ft above sea level, derate the unit 10%.
**581B036 with 150,000 Btuh input not available.
††581B036115 at high fire operation. At low fire, manifold pressure is 1.8 in. wg, and heating input is 82,000 Btuh.
‖581B048-072150 at high fire operation. At low fire, manifold pressure is 2.2 in. wg, and heating input is 120,000 Btuh.

Table 6 — Altitude Compensation* — Units 581B036-072

ELEVATION (ft)	72,000 AND 115,000 BTUH NOMINAL INPUT		150,000 BTUH NOMINAL INPUT	
	Natural Gas Orifice Size†	Liquid Propane Orifice Size†	Natural Gas Orifice Size†	Liquid Propane Orifice Size†
0-2,000	33	43	30	38
2,000	34	43	30	39
3,000	35	44	31	40
4,000	36	44	32	41
5,000	36	44	33	42
6,000	37	45	34	43
7,000	37	45	35	43
8,000	38	46	36	44
9,000	39	47	37	44
10,000	41	48	38	45
11,000	43	48	39	45
12,000	44	49	40	46
13,000	44	49	41	47
14,000	45	50	42	47

*As the height above sea level increases, there is less oxygen per cubic foot of air. Therefore, heat input rate should be reduced at higher altitudes.
†Orifices are available through your local distributor or branch.

NOTE: The gas manifold is equipped with a plug located approximately 5 in. down from the gas valve which may also be used to connect the manometer.

3. Record number of seconds for gas meter test dial to make one revolution.
4. Divide number of seconds in Step 3 into 3600 (number of seconds in 1 hour).
5. Multiply result of Step 4 by the number of cubic ft shown for one revolution of test dial to obtain cubic ft of gas flow per hour.
6. Multiply result of Step 5 by Btu heating value of gas to obtain total measured input in Btuh. Compare this value with heating input shown in Table 1. (Consult the local gas supplier if the heating value of gas is not known.)

EXAMPLE: Assume that the size of test dial is 1 cubic ft, one revolution takes 33 seconds, and the heating value of the gas is 1050 Btu/ft^3, then proceed as follows:

1. 33 seconds to complete one revolution.
2. 3600 ÷ 33 = 109
3. 109 x 1 = 109 ft^3 of gas flow/hr
4. 109 x 1050 = 114,450 Btuh input

If the desired gas input is 115,000 Btuh, only a minor change in the manifold pressure is required.

Observe manifold pressure and proceed as follows to adjust gas input:

1. Remove cover screw over regulator adjustment screw on gas valve. See Fig. 31.
2. Turn regulator adjustment screw clockwise to increase gas input, or turn regulator adjustment screw counterclockwise to decrease input. Manifold pressure must be between 3.2 and 3.8 in. wg on high-fire, two-stage units.

⚠ **WARNING:** Unsafe operation of the unit may result if manifold pressure is outside this range. Personal injury or unit damage may result.

3. Replace cover screw cap on gas valve.
4. Turn off gas supply to unit.
5. Remove manometer from pressure tap.
6. Replace pipe plug on gas valve or manifold.
7. Turn on gas to unit.
8. Check for leaks.

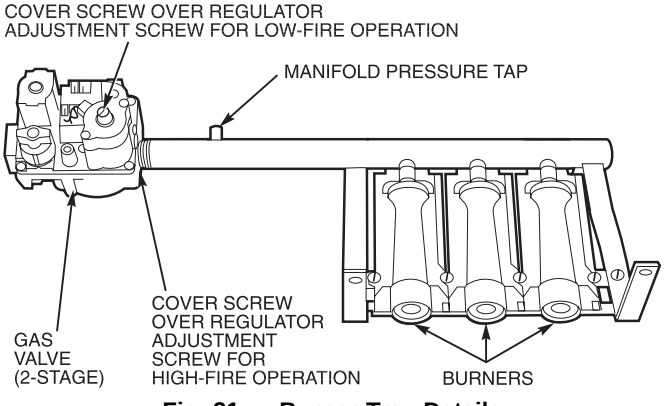

COVER SCREW OVER REGULATOR ADJUSTMENT SCREW FOR LOW-FIRE OPERATION
MANIFOLD PRESSURE TAP
GAS VALVE (2-STAGE)
COVER SCREW OVER REGULATOR ADJUSTMENT SCREW FOR HIGH-FIRE OPERATION
BURNERS

Fig. 31 — Burner Tray Details

Measuring Manifold Pressure — LP Gas Units

The main burner orifices on LP gas unit are sized for the unit rated input when the manifold pressure is 3.5 in. wg (high-fire on two-stage units).

Proceed as follows to adjust gas input on an LP gas unit:

1. Turn off gas to unit.
2. Remove pipe plug on outlet of gas valve or manifold.
3. Connect manometer.

NOTE: The gas manifold is equipped with a plug located approximately 5 in. down from the gas valve which may also be used to connect the manometer.

4. Turn on gas to unit.
5. Remove cover screw over regulator adjustment screw on gas valve. See Fig. 31.
6. Adjust regulator adjustment screw for a manifold pressure reading of 3.5 in. wg (high fire on two-stage units). Turn adjusting screw clockwise to increase manifold pressure, or turn adjusting screw counterclockwise to decrease manifold pressure.
7. Replace cover screw.
8. Turn off gas to unit.
9. Remove manometer from pressure tap.
10. Replace pipe plug on gas valve or manifold.
11. Turn on gas to unit, and check for leaks.

F. Check Burner Flame and Ignition

Observe the unit heating operation. Watch the burner flames through the access door to see if they are light blue and soft in appearance and if the flames are approximately the same for each burner. See Fig. 32.

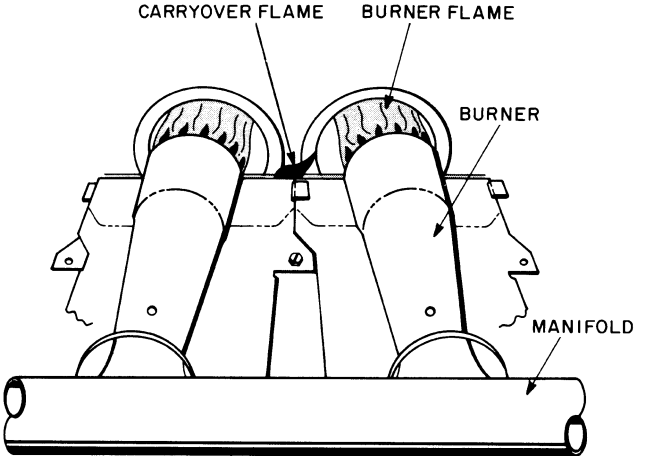


Fig. 32 — Monoport Burners

Main burners are factory set and should require no adjustment.

To check ignition of main burners and heating controls, move thermostat set point above room temperature and verify that the burners light and evaporator fan is energized. Check heating effect, then lower the thermostat setting below the room temperature and verify that the burners and evaporator fan turn off.

Refer to Table 6 for the correct orifice to use at high altitudes.

G. Airflow and Temperature Rise

The heating section of each side of unit is designed and approved for heating operation within the temperature rise range stamped on the unit rating plate. Temperature rise range is also found in Table 1.

The heating operation airflow must produce a temperature rise that falls within the approved range.

Refer to Care and Maintenance section on page 28 to adjust heating airflow when required.

H. Safety Check of Limit Control

Limit control is located on the deck next to the evaporator fan. The control shuts off the gas supply and energizes the evaporator-fan motor and inducer motor if the unit overheats.

The recommended method of checking this limit control is to gradually block off the return air after the unit has been operating for a period of at least 5 minutes. As soon as the limit control functions, the return-air opening should be unblocked to permit normal air circulation. By using this method to check the limit control, it can be established that the limit is functioning properly and the unit will "fail-safe" if there is a restricted circulating air supply or motor failure. If the limit control does not function during this test, the cause must be determined and corrected.

I. Heating Sequence of Operation

Heating, Units Without Economizer

When the thermostat calls for heating, terminal W1 is energized. In order to prevent thermostat short-cycling, the unit is locked into the Heating mode for at least 1 minute when W1 is energized. The induced-draft motor is energized and burner ignition sequence begins. The indoor (evaporator) fan motor (IFM) is energized 45 seconds after a flame is ignited. When additional heat is needed, W2 is energized and the high-fire solenoid on the main gas valve (MGV) is energized. When the thermostat is satisfied and W1 is deenergized, the IFM stops after a 45-second time-off delay.

Heating, Units With Economizer

When the thermostat calls for heating, terminal W1 is energized. In order to prevent thermostat short-cycling, the unit is locked into the Heating mode for at least 1 minute when W1 is energized. The induced-draft motor is energized and the burner ignition sequence begins. The indoor (evaporator) fan motor (IFM) is energized 45 seconds after a flame is ignited and the damper moves to the minimum position. If the two-position damper is used, the outdoor-air damper opens to the minimum position whenever the evaporator-fan runs. When additional heat is needed, W2 is energized and the high-fire solenoid on the main gas valve (MGV) is energized. When the thermostat is satisfied and W1 is energized, the IFM stops after a 45-second time-off delay. The economizer damper then moves to the fully-closed position. When using continuous fan, the damper will remain in the minimum position.

J. Limit Switches

Heating limit switch (LS) deenergizes the gas valve and the Integrated Gas Unit Controller (IGC) if the leaving-air temperature exceeds the maximum allowable temperature.

Normally-closed limit switch completes a circuit to the gas valve. Should the leaving-air temperature rise above the maximum allowable temperature, the limit switch opens, instantly closing the gas valve and stopping gas flow to the burners. The inducer motor and the evaporator motor are energized to cool heat exchanger.

When the air temperature at the limit switch drops to the low-temperature setting of the limit switch, the switch closes and completes the gas valve circuit. The electric-spark ignition system cycles and the unit returns to normal heating operation.

K. Rollout Switch

Rollout switch (RS) is a temperature-actuated automatic reset switch connected in series with heating limit switch. The function of the switch is to close the main gas valve in the

event of flame rollout. The switch is located above the main burners on the internal wind baffle. When the temperature at the rollout switch exceeds the maximum allowable temperature, the W control circuit trips, deenergizing the gas valve and stopping gas flow to the burners. The inducer motor is energized when the rollout switch trips. Although the rollout switch has an automatic reset, the IGC locks out the unit when a trip occurs and must be reset at unit disconnect. If the switch cycles again, shut down the unit and call for service.

III. COOLING SECTION START-UP AND ADJUSTMENTS

⚠**CAUTION:** Complete the required procedures given in the Pre-Start-Up section on page 17 before starting the unit.

Do not jumper any safety devices when operating the unit.

Do not operate the compressor when the outdoor temperature is below 25 F (unless accessory low ambient kit is installed).

Do not rapid-cycle the compressor. Allow 5 minutes between "on" cycles to prevent compressor damage.

A. Checking Cooling Control Operation

Start and check the unit for proper cooling control operation as follows:

1. Place room thermostat SYSTEM switch in OFF position. Observe that blower motor starts when FAN switch is placed in ON position and shuts down when FAN switch is placed in AUTO. position.
2. Place SYSTEM switch in COOL position and FAN switch in AUTO. position. Set cooling control below room temperature. Observe that compressor, condenser-fan motor, and evaporator-fan motor start. Observe that cooling cycle shuts down when control setting is satisfied, or reset thermostat at a position above room temperature. Compressor will shut off. Evaporator fan will shut off after a 30-second delay.
3. Check unit charge. See Section B below.
4. To shut off unit, set system selector switch at OFF position. Resetting thermostat at a position above room temperature shuts unit off temporarily until space temperature exceeds thermostat setting. Units are equipped with Cycle-LOC™ protection device. Unit shuts down on any safety trip, and indicator light on thermostat comes on. Check reason for all safety trips.
5. When using an autochangeover room thermostat, place both SYSTEM and FAN switches in AUTO. positions. Observe that unit operates in Heating mode when temperature control is set to call for heating (above room temperature) and operates in Cooling mode when temperature control is set to call for cooling (below room temperature).
6. Compressor restart is accomplished by manual reset at the thermostat by turning the selector switch to OFF and then to ON positions.

B. Checking and Adjusting Refrigerant Charge

The refrigerant system contains R-22 refrigerant, and is fully charged, tested, and factory-sealed.

NOTE: Adjustment of the refrigerant charge is not required unless the unit is suspected of not having the proper R-22 charge. This unit uses charging charts to determine proper charge. See Refrigerant Charge section on page 29 for further details.

C. Unit Controls

All compressors have the following internal-protection controls:

1. *High-Pressure Relief Valve* — This valve (internal to the compressor) opens when the pressure differential between the low and high side becomes excessive and will automatically reset when pressure returns to normal.
2. *Compressor Overload* — This overload interrupts power to the compressor when either the current or internal temperature become excessive, and automatically resets when the internal temperature drops to a safe level. This overload may require up to 60 minutes (or longer) to reset; therefore, if the internal overload is suspected of being open, disconnect the electrical power to the unit and check the circuit through the overload with an ohmmeter or continuity tester.

D. Cooling Sequence of Operation

Cooling, Units Without Economizer

When thermostat calls for cooling, terminals G and Y1 and the compressor contactor are energized. The indoor (evaporator) fan motor (IFM), compressor, and outdoor (condenser) fan motor (OFM) start. The OFM runs continuously while the unit is in cooling. When the thermostat is satisfied, C1 is deenergized and the compressor and OFM shut off. After a 30-second delay, the IFM shuts off. If the thermostat fan selector switch is in the ON position, the evaporator motor will run continuously.

Cooling, Units With Varislide™ Economizer

When the outdoor-air temperature is above the OAT setting and the room thermostat calls for cooling, compressor contactor is energized to start the compressor and outdoor (condenser) fan motor (OFM). The evaporator (indoor) fan motor (IFM) is energized and the economizer damper moves to the minimum position. After the thermostat is satisfied, the damper moves to the fully closed position when IFM is deenergized.

When the outdoor-air temperature is below the OAT setting and the thermostat calls for Y1 and G (cooling), the economizer damper moves to the minimum position when the evaporator-fan starts. The first stage of cooling is provided by the economizer. If the supply-air temperature is above 57 F, a switch on the supply-air thermostat is closed between the T2 terminal and the 24 vac terminal. This causes the damper to continue to modulate open until the supply-air temperature falls below 55 F or the damper reaches the fully open position.

When the supply-air temperature is between 55 F and 52 F, the supply-air thermostat has open switches between the T2 and 24 vac terminals and between the T1 and 24 vac terminals. This causes the economizer damper to remain in an intermediate open position.

If the supply-air temperature falls below 52 F, a switch on the supply-air thermostat is closed between the T1 terminal and the 24 vac terminal. This causes the damper to modulate closed until the supply-air temperature rises above 55 F or the damper reaches the minimum position.

When the supply-air temperature is between 55 F and 57 F, the supply-air thermostat has open switches between the T2 and 24 vac terminals. This causes the economizer damper to remain in an intermediate open position.

If the outdoor air alone cannot satisfy the cooling requirements of the conditioned space, economizer cooling is integrated with mechanical cooling, providing second stage cooling. The compressor and condenser fan will be energized and the position of the economizer damper will be determined by the supply-air temperature.

When the second stage of cooling is satisfied, the compressor and OFM will be deenergized. The damper position will be determined by the supply-air temperature.

When the first stage of cooling is satisfied, there is a 30-second delay before evaporator shuts off (036-060). The damper will move to fully closed position.

Cooling, Units with PARABLADE Economizer

When the outdoor-air is above the enthalpy control setting, and the room thermostat calls for cooling, the compressor contactor is energized to start the compressor and the condenser (outdoor) fan motor. The evaporator (indoor) fan motor is energized and the economizer damper moves to the minimum position. After the room thermostat is satisfied the damper will spring return to the full closed position.

When the outdoor-air is below the enthalpy control setting and the thermostat calls for cooling, the economizer outdoor air damper is opened proportionally to maintain between 50 and 56 F at the mixed air sensor. If outside air alone cannot satisfy the cooling requirements, economizer cooling is integrated with mechanical cooling. When the room thermostat is satisfied, the damper will spring return to the fully closed position.

Time Guard® II Device

If the unit is equipped with accessory Time Guard II recycle timer, the unit will delay 5 minutes between compressor starts.

Low-Pressure Switch (LPS)

When the liquid line pressure drops below 7 psig, the LPS opens 24-v power to the compressor contactor and stops the compressor. When the pressure reaches 22 psig, the switch resets and the compressor is allowed to come back on.

High-Pressure Switch (HPS)

When the refrigerant high-side pressure reaches 428 psig, the HPS opens 24-v power to the compressor contactor and stops the compressor. When the pressure drops to 320 psig, the switch resets and the compressor is allowed to restart.

Freeze Protection Thermostat (FPT)

When the evaporator coil leaving refrigerant temperature drops below 30 F, the FPT opens 24-v power to the compressor contactor and stops the compressor. When the leaving refrigerant temperature warms to 45 F, the switch resets and the compressor is allowed to restart.

IV. INDOOR AIRFLOW AND AIRFLOW ADJUSTMENTS

⚠ **CAUTION:** For cooling operation, the recommended airflow is 300 to 500 cfm per each 12,000 Btuh of rated cooling capacity. For heating operation, the airflow must produce a temperature rise that falls within the range stamped on the unit rating plate.

Adjust evaporator-fan speed to meet jobsite conditions and temperature rise in Table 1. Table 7 shows fan rpm at motor pulley settings. Table 8 shows evaporator-fan motor performance. Refer to Tables 9-16 to determine fan speed settings.

A. Belt Drive Motors

Fan motor pulleys are factory set for speed shown in Table 1. Check pulley alignment and belt tension prior to start-up.

NOTE: Before adjusting fan speed, make sure the new fan speed will provide an air temperature rise range as shown in Table 1.

To change fan speed:

1. Shut off unit power supply.
2. Loosen belt by loosening fan motor mounting nuts. See Fig. 33.
3. Loosen movable pulley flange setscrew (see Fig. 34).
4. Screw movable flange toward fixed flange to increase speed and away from fixed flange to decrease speed. Increasing fan speed increases load on motor. Do not exceed maximum speed specified in Table 1.
5. Set movable flange at nearest keyway of pulley hub and tighten setscrew. (See Table 1 for speed change for each full turn of pulley flange.)

To align fan and motor pulleys:

1. Loosen fan pulley setscrews.
2. Slide fan pulley along fan shaft.
3. Make angular alignment by loosening motor from mounting.

To adjust belt tension:

1. Loosen fan motor nuts.
2. Slide motor mounting plate away from fan scroll for proper belt tension (½-in. deflection with one finger) and tighten mounting nuts.
3. Adjust lock bolt and nut on mounting plate to secure motor in fixed position.

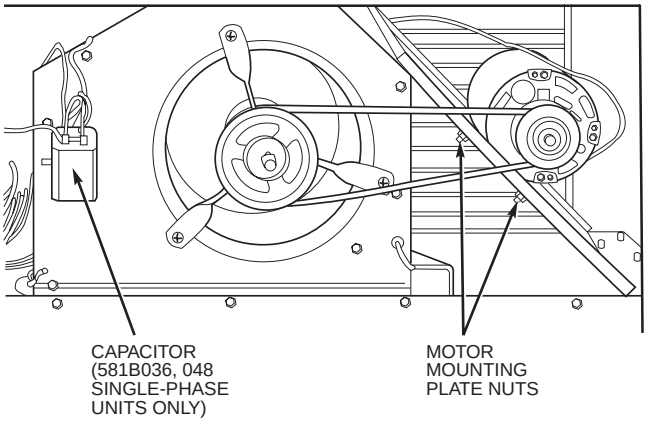


Fig. 33 — Belt Drive Motor Mounting

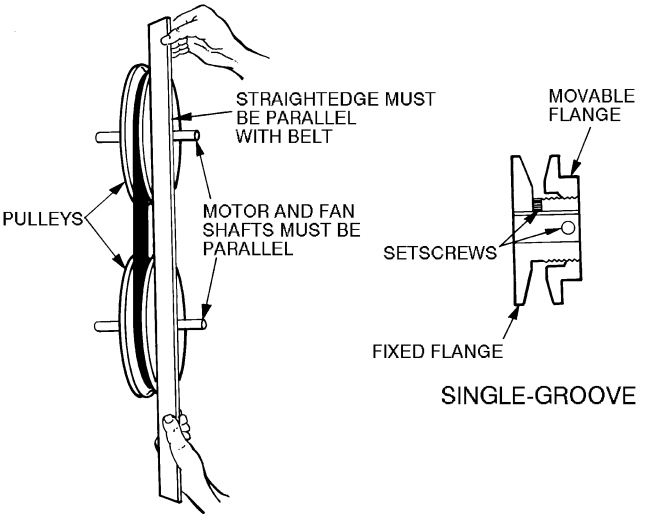


Fig. 34 — Evaporator-Fan Pulley Adjustment

B. Ventilation Sequence

If unit is equipped with an economizer, the damper will open to the minimum position whenever the evaporator fan runs.

The damper motor will be energized with 24 vac power and damper will drive open until SW3 on the damper is deactivated. The damper motor will stop and damper will remain in the minimum ventilation position until the evaporator fan is shut off. When the evaporator fan is shut off, the damper motor is again energized and the damper runs closed until SW2 is activated and the damper motor turns off.

When unit is equipped with an economizer, additional outdoor air can be brought in through the damper to provide cooling. If the unit calls for cooling and the outdoor-air temperature is below the outdoor-air thermostat (OAT) setting or the outdoor-air enthalpy is below the enthalpy control (EC) setting, the damper motor starts. The damper drives open until it reaches full open and SW1 is activated. When SW1 is deactivated, the damper motor stops. When the cooling load is satisfied, or outdoor air is no longer below the OAT or EC setting, the damper returns to the minimum position.

If the supply-air thermostat (located on the evaporator-fan housing) senses a supply-air temperature less than 50 F, the damper closes until the supply-air temperature is above 50 F.

Table 7 — Fan Rpm at Motor Pulley Settings*

UNIT 581B	MOTOR PULLEY TURNS OPEN												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
036	1090	1055	1025	990	960	925	890	860	825	795	760	—	—
048	1185	1150	1115	1080	1045	1015	980	945	910	875	840	—	—
060	1460	1425	1385	1350	1315	1275	1240	1205	1165	1130	1095	1055	1020
072	1585	1540	1490	1445	1400	1350	1305	1260	1210	1165	1120	—	—

*Approximate fan rpm shown.

Table 8 — Evaporator Fan Motor Data

UNIT 581B	PHASE	MAXIMUM CONTINUOUS BHP*	UNIT VOLTAGE	MAXIMUM AMP DRAW
036	Single	1.20	208/230	5.4
	Three	1.20	208/230	5.4
			460	2.4
			575	2.4
048	Single	1.20	208/230	5.4
	Three	1.20	208/230	5.4
			460	2.4
			575	2.4
060	Single	1.80	208/230	9.7
	Three	1.80	208/230	6.4
			460	2.9
			575	2.9
072	Three	2.40	208/230	6.4
			460	2.9
			575	2.9

LEGEND

Bhp — Brake Horsepower

*Extensive motor and electrical testing on these units ensures that the full horsepower range of the motors can be utilized with confidence. Using your fan motors up to the ratings shown in this table will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.

Table 9 — 581B036 Air Delivery — Vertical Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.1		0.2		0.3		0.4		0.5		0.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
900	**581**	**0.12**	**673**	**0.18**	**736**	**0.22**	805	0.25	865	0.29	911	0.34
1000	**644**	**0.19**	**709**	**0.22**	782	0.28	835	0.30	900	0.35	937	0.38
1100	**687**	**0.22**	**746**	**0.26**	806	0.30	867	0.35	929	0.40	964	0.40
1200	**733**	**0.26**	785	0.32	843	0.35	903	0.41	960	0.47	994	0.50
1300	**754**	**0.29**	826	0.38	891	0.43	942	0.48	991	0.53	1047	0.60
1400	810	0.35	868	0.45	937	0.51	984	0.57	1032	0.62	1067	0.67
1500	841	0.42	911	0.53	985	0.61	1029	0.66	1073	0.72	**1109**	**0.77**

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.7		0.8		0.9		1.0		1.1		1.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
900	957	0.39	988	0.43	1039	0.47	1061	0.51	1083	0.54	**1105**	**0.58**
1000	992	0.44	1039	0.49	1061	0.55	1088	0.60	**1111**	**0.66**	**1136**	**0.72**
1100	1013	0.49	1068	0.55	**1091**	**0.61**	**1109**	**0.66**	**1127**	**0.73**	**1145**	**0.80**
1200	1045	0.56	1090	0.64	**1109**	**0.68**	**1156**	**0.73**	**1203**	**0.81**	**1250**	**0.86**
1300	1075	0.64	**1122**	**0.70**	**1152**	**0.76**	**1190**	**0.82**	**1228**	**0.87**	**1266**	**0.94**
1400	**1110**	**0.73**	**1160**	**0.78**	**1181**	**0.83**	**1237**	**0.88**	**1293**	**0.94**	**1349**	**0.99**
1500	**1150**	**0.78**	**1190**	**0.84**	**1225**	**0.89**	**1271**	**0.95**	**1317**	**1.00**	**1383**	**1.05**

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates a field-supplied drive is required. (See Note 2.)
2. Motor drive range is 760 to 1090 rpm. All other rpms require a field-supplied drive.
3. Values include losses for filters, unit casing, and wet coils.
4. Maximum continuous bhp is 1.2. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
5. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
6. Interpolation is permissible. Do not extrapolate.
7. Minimum allowable cfm is 300 cfm/ton.

Table 10 — 581B048 Air Delivery — Vertical Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR													
	External Static Pressure (in. wg)													
	0.1		0.2		0.3		0.4		0.6		0.7		0.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	**596**	**0.20**	**665**	**0.25**	**722**	**0.31**	**779**	**0.36**	872	0.48	915	0.54	957	0.60
1300	**633**	**0.24**	**699**	**0.30**	**754**	**0.36**	**809**	**0.42**	902	0.55	943	0.61	984	0.67
1400	**672**	**0.30**	**735**	**0.36**	**788**	**0.42**	840	0.48	933	0.62	972	0.69	1011	0.75
1500	**711**	**0.35**	**770**	**0.42**	**822**	**0.49**	873	0.55	963	0.69	1002	0.77	1041	0.84
1600	**751**	**0.42**	**835**	**0.49**	871	0.56	907	0.63	993	0.77	1033	0.85	1072	0.93
1700	**791**	**0.49**	873	0.57	907	0.65	941	0.72	1024	0.87	1064	0.96	1103	1.04
1800	**831**	**0.58**	881	0.66	929	0.74	976	0.81	1057	0.97	1095	1.06	1132	1.14
1900	872	0.67	919	0.75	965	0.84	1011	0.92	1091	1.08	1127	1.17	1162	1.25
2000	913	0.77	958	0.86	1002	0.95	1046	1.03	1125	1.21	1160	1.30	1195	1.38

AIRFLOW (Cfm)	BELT DRIVE MOTOR													
	External Static Pressure (in. wg)													
	0.9		1.0		1.1		1.2		1.4		1.6		1.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	993	0.65	1028	0.69	1056	0.72	1083	0.74	1134	0.80	1185	0.88	**1331**	**0.99**
1300	1021	0.74	1058	0.80	1090	0.85	1121	0.89	1171	0.94	**1219**	**1.00**	**1268**	**1.10**
1400	1049	0.82	1086	0.89	1120	0.96	1153	1.00	**1210**	**1.12**	**1257**	**1.17**	1307	1.25
1500	1077	0.92	1113	0.99	1147	1.06	1180	1.13	1241	1.27	1295	1.37	1339	1.43
1600	1107	1.00	1141	1.09	1174	1.17	1207	1.25	1269	1.40	1326	1.54	1376	1.65
1700	1137	1.12	1171	1.20	1203	1.29	1235	1.37	1296	1.53	1354	1.70	1407	1.84
1800	1167	1.23	1202	1.32	1233	1.41	1263	1.49	1323	1.67	1381	1.85	1436	2.02
1900	1197	1.35	1232	1.45	1263	1.54	1294	1.63	1351	1.81	1408	2.00	1463	2.19
2000	1229	1.48	1262	1.58	1294	1.68	1325	1.78	1362	1.97	1436	2.16	1489	2.36

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive is required. (See Note 4.)
2. ▭ indicates field-supplied motor and drive required.
3. ——— indicates maximum usable bhp.
4. Motor drive range is 840 to 1185 rpm. All other rpms require a field-supplied drive.
5. Values include losses for filters, unit casing, and wet coils.
6. Maximum continuous bhp is 1.2. Extensive motor and electrical testing on these units ensure that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
8. Interpolation is permissible. Do not extrapolate.
9. Minimum allowable cfm is 300 cfm/ton.

Table 11 — 581B060 Air Delivery — Vertical Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.1		0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	**771**	**0.37**	**828**	**0.44**	**935**	**0.58**	1027	0.73	1107	0.88	1185	1.04
1600	**816**	**0.45**	**869**	**0.51**	**968**	**0.66**	1056	0.81	1127	0.97	1215	1.14
1700	**902**	**0.61**	**940**	**0.62**	**1007**	**0.75**	1094	0.91	1175	1.09	1245	1.26
1800	**942**	**0.70**	**978**	**0.66**	1063	0.82	1147	0.97	1248	1.20	1322	1.33
1900	**982**	**0.80**	1023	0.78	1097	0.91	1175	1.11	1266	1.29	1356	1.47
2000	1022	0.91	1068	0.90	1132	1.01	1218	1.23	1303	1.41	1397	1.52
2100	1063	0.99	1115	1.00	1180	1.17	1261	1.35	1340	1.53	1428	1.66
2200	1104	1.13	1159	1.15	1214	1.28	1310	1.52	1375	1.63	1459	1.80
2300	1130	1.26	1202	1.29	1248	1.38	1358	1.69	1410	1.72	1488	1.93
2400	1174	1.37	1237	1.41	1292	1.55	1392	1.81	1460	1.90	1532	2.14
2500	1201	1.48	1272	1.53	1335	1.71	1427	1.94	1518	2.16	1575	2.35

AIRFLOW (Cfm)	BELT DRIVE MOTOR					
	External Static Pressure (in. wg)					
	1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	1257	1.20	1330	1.38	1411	1.59
1600	1286	1.31	1353	1.49	1421	1.68
1600	1315	1.44	1381	1.52	1443	1.69
1800	1395	1.46	**1475**	**1.56**	**1542**	**1.71**
1900	1430	1.58	**1504**	**1.69**	1556	1.82
2000	1459	1.67	1532	1.82	1588	1.97
2100	**1489**	**1.80**	1567	1.99	1626	2.16
2200	1528	1.95	1603	2.17	1666	2.37
2300	1561	2.13	1637	2.35	1710	2.54
2400	1584	2.28	1671	2.55	1756	2.70
2500	1633	2.53	1698	2.72	—	—

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive is required. (See Note 4.)
2. ▭ indicates field-supplied motor and drive required.
3. ——— indicates maximum usable bhp.
4. Motor drive range is 1020 to 1460 rpm. All other rpms require a field-supplied drive.
5. Values include losses for filters, units casing, and wet coils.
6. Maximum continuous bhp is 1.8. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
8. Interpolation is permissible. Do not extrapolate.
9. Minimum allowable cfm is 300 cfm/ton.

Table 12 — 581B072 Air Delivery — Vertical Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.1		0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1800	**942**	**0.70**	**978**	**0.66**	**1063**	**0.82**	1147	0.97	1248	1.20	1322	1.33
1900	**982**	**0.80**	**1023**	**0.78**	**1097**	**0.91**	1175	1.11	1266	1.29	1356	1.47
2000	**1022**	**0.91**	**1068**	**0.90**	1132	1.01	1218	1.23	1303	1.41	1397	1.52
2100	**1063**	**0.99**	**1115**	**1.00**	1180	1.17	1261	1.35	1340	1.53	1428	1.66
2200	**1104**	**1.13**	1159	1.15	1214	1.28	1310	1.52	1375	1.63	1459	1.80
2300	1130	1.26	1202	1.29	1248	1.38	1358	1.69	1410	1.72	1488	1.93
2400	1174	1.37	1237	1.41	1292	1.55	1392	1.81	1460	1.90	1532	2.14
2500	1201	1.48	1272	1.53	1335	1.71	1427	1.94	1518	2.16	1575	2.35
2600	1246	1.62	1320	1.68	1368	1.81	1458	2.06	1562	2.42	1620	2.59
2700	1285	1.75	1361	1.82	1400	1.91	1490	2.19	1602	2.64	1666	2.85
2800	1304	1.87	1402	1.95	1439	2.08	1543	2.43	1642	2.86	—	—
2900	1345	2.07	1446	2.16	1477	2.16	1585	2.65	—	—	—	—
3000	1378	2.26	1489	2.36	1529	2.52	1598	2.73	—	—	—	—

AIRFLOW (Cfm)	BELT DRIVE MOTOR					
	External Static Pressure (in. wg)					
	1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1800	1395	1.46	1475	1.56	1542	1.71
1900	1430	1.58	1504	1.69	1556	1.82
2000	1459	1.67	1532	1.82	**1588**	**1.97**
2100	1489	1.80	1567	1.99	**1626**	**2.16**
2200	1528	1.95	**1603**	**2.17**	**1666**	**2.37**
2300	1561	2.13	**1637**	**2.35**	1710	2.54
2400	1584	2.28	1671	2.55	1756	2.70
2500	1633	2.53	1698	2.72	—	—
2600	1675	2.77	—	—	—	—
2700	—	—	—	—	—	—
2800	—	—	—	—	—	—
2900	—	—	—	—	—	—
3000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive is required. (See Note 4.)
2. ▭ indicates field-supplied motor and drive required.
3. ——— indicates maximum usable bhp.
4. Motor drive range is 1120 to 1585 rpm. All other rpms require a field-supplied drive.
5. Values include losses for filters, units casing, and wet coils.
6. Maximum continuous bhp is 2.40. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
8. Interpolation is permissible. Do not extrapolate.
9. Minimum allowable cfm is 300 cfm/ton.

Table 13 — 581B036 Air Delivery — Horizontal Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.1		0.2		0.3		0.4		0.5		0.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
900	**526**	**0.06**	**584**	**0.08**	**656**	**0.12**	**734**	**0.22**	818	0.25	875	0.27
1000	**570**	**0.09**	**627**	**0.13**	**738**	**0.19**	800	0.26	848	0.29	895	0.31
1100	**614**	**0.13**	**670**	**0.16**	**758**	**0.23**	812	0.29	863	0.32	914	0.35
1200	**658**	**0.16**	**710**	**0.23**	780	0.28	840	0.32	889	0.36	938	0.40
1300	**703**	**0.20**	**752**	**0.27**	808	0.32	868	0.37	916	0.41	963	0.45
1400	**725**	**0.29**	776	0.31	845	0.38	891	0.42	937	0.47	983	0.51
1500	**755**	**0.33**	816	0.38	870	0.43	924	0.48	969	0.53	1014	0.58

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.7		0.8		0.9		1.0		1.1		1.2	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
900	924	0.32	953	0.35	989	0.38	1028	0.42	1074	0.45	**1120**	**0.50**
1000	936	0.35	977	0.39	1020	0.44	1064	0.48	**1124**	**0.52**	**1185**	**0.55**
1100	960	0.39	1005	0.43	1052	0.49	**1100**	**0.52**	**1163**	**0.56**	**1225**	**0.60**
1200	988	0.45	1038	0.50	1076	0.53	**1136**	**0.59**	**1201**	**0.61**	**1266**	**0.64**
1300	1012	0.51	1061	0.56	**1094**	**0.61**	**1172**	**0.65**	**1239**	**0.69**	**1306**	**0.72**
1400	1027	0.56	1071	0.60	**1108**	**0.67**	**1208**	**0.70**	**1278**	**0.75**	**1347**	**0.79**
1500	1056	0.63	**1097**	**0.68**	**1117**	**0.70**	**1245**	**0.74**	**1315**	**0.80**	**1385**	**0.85**

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive required. (See Note 2.)
2. Motor drive range is 760 to 1090 rpm. All other rpms require field-supplied drive.
3. Values include losses for filters, unit casing, and wet coils.
4. Maximum continuous bhp is 1.2. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
5. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
6. Interpolation is permissible. Do not extrapolate.
7. Minimum allowable cfm is 300 cfm/ton.

Table 14 — 581B048 Air Delivery — Horizontal Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR													
	External Static Pressure (in. wg)													
	0.1		0.2		0.3		0.4		0.6		0.7		0.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	**569**	**0.18**	**641**	**0.23**	**701**	**0.29**	**761**	**0.34**	859	0.46	901	0.52	943	0.58
1300	**604**	**0.22**	**673**	**0.28**	**731**	**0.34**	**788**	**0.39**	887	0.52	928	0.59	968	0.65
1400	**640**	**0.27**	**705**	**0.33**	**761**	**0.39**	**817**	**0.45**	914	0.59	955	0.66	996	0.72
1500	**676**	**0.32**	**738**	**0.38**	**793**	**0.45**	847	0.51	940	0.65	982	0.73	1024	0.81
1600	**713**	**0.38**	**772**	**0.44**	**825**	**0.51**	877	0.58	967	0.73	1009	0.81	1051	0.89
1700	**750**	**0.45**	**806**	**0.51**	857	0.59	908	0.66	997	0.81	1037	0.90	1077	1.01
1800	**788**	**0.52**	841	0.59	890	0.67	939	0.75	1026	0.91	1065	1.01	1104	1.07
1900	**826**	**0.60**	876	0.68	924	0.76	971	0.84	1056	1.01	1094	1.10	1132	1.18
2000	864	0.70	912	0.77	958	0.86	1004	0.94	1087	1.12	1125	1.21	1162	1.30

AIRFLOW (Cfm)	BELT DRIVE MOTOR													
	External Static Pressure (in. wg)													
	0.9		1.0		1.1		1.2		1.4		1.6		1.8	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1200	987	0.64	1030	0.70	1068	0.79	1106	0.87	1134	0.98	**1189**	**1.12**	1245	1.21
1300	1006	0.71	1044	0.77	1086	0.84	1128	0.91	1183	1.10	1226	1.23	1297	1.35
1400	1033	0.79	1069	0.86	1104	0.93	1139	1.01	**1218**	**1.14**	1286	1.34	1320	1.48
1500	1060	0.88	1095	0.95	1129	1.02	1162	1.09	1228	1.24	1303	1.40	1343	1.60
1600	1087	1.01	1123	1.05	1156	1.13	1185	1.20	1250	1.35	1319	1.51	1382	1.68
1700	1114	1.07	1151	1.15	1183	1.23	1215	1.31	1276	1.48	1334	1.64	1398	1.80
1800	1141	1.17	1178	1.26	1211	1.35	1243	1.43	1303	1.61	1359	1.78	1418	1.95
1900	1168	1.28	1204	1.37	1238	1.47	1271	1.56	1330	1.74	1386	1.93	1439	2.11
2000	1197	1.39	1231	1.48	1265	1.59	1298	1.69	1358	1.89	1413	2.08	1466	2.27

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive required. (See Note 4.)
2. ▭ indicates field-supplied motor and drive required.
3. ——— indicates maximum usable bhp.
4. Motor drive range: 840 to 1185 rpm. All other rpms require a field-supplied drive.
5. Values include losses for filters, unit casing, and wet coils.
6. Maximum continuous bhp is 1.2. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
8. Interpolation is permissible. Do not extrapolate.
9. Minimum allowable cfm is 300 cfm/ton.

Table 15 — 581B060 Air Delivery — Horizontal Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.1		0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	**741**	**0.38**	**798**	**0.43**	**895**	**0.54**	**990**	**0.67**	1073	0.80	1154	0.95
1600	**783**	**0.45**	**838**	**0.51**	**933**	**0.63**	**1016**	**0.75**	1102	0.90	1182	1.04
1700	**825**	**0.53**	**878**	**0.60**	**969**	**0.72**	1049	0.84	1134	1.00	1206	1.14
1800	**885**	**0.63**	**942**	**0.73**	1047	0.90	1139	1.05	1193	1.14	1276	1.30
1900	**928**	**0.73**	**982**	**0.83**	1084	1.02	1160	1.11	1223	1.24	1301	1.38
2000	**971**	**0.84**	1022	0.94	1121	1.12	1188	1.22	1254	1.36	1329	1.44
2100	**1015**	**0.97**	1063	1.10	1140	1.18	1196	1.27	1272	1.45	1354	1.58
2200	1060	1.10	1104	1.20	1159	1.23	1229	1.41	1306	1.53	1363	1.70
2300	1104	1.25	1130	1.27	1196	1.37	1264	1.56	1340	1.66	1397	1.86
2400	1138	1.30	1174	1.37	1245	1.57	1305	1.63	1373	1.84	1440	1.95
2500	1183	1.43	1201	1.50	1284	1.65	1338	1.75	1402	1.99	1469	2.04

AIRFLOW (Cfm)	BELT DRIVE MOTOR					
	External Static Pressure (in. wg)					
	1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1500	1218	1.12	1295	1.36	1360	1.40
1600	1251	1.20	1310	1.40	1385	1.49
1700	1281	1.31	1342	1.48	1398	1.53
1800	1341	1.40	1413	1.55	**1474**	**1.58**
1900	1374	1.53	1437	1.62	**1490**	**1.67**
2000	1396	1.66	1460	1.68	**1509**	**1.77**
2100	1413	1.75	**1475**	**1.73**	1529	1.92
2200	1434	1.81	1487	1.85	1554	2.07
2300	1459	1.88	1520	2.07	1576	2.24
2400	1502	2.06	1552	2.24	1604	2.42
2500	1524	2.24	1585	2.42	1638	2.60

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive is required. (See Note 4.)
2. ▭ indicates field-supplied motor and drive required.
3. ——— indicates maximum usable bhp.
4. Motor drive range is 1020 to 1460 rpm. All other rpms require a field-supplied drive.
5. Values include losses for filters, units casing, and wet coils.
6. Maximum continuous bhp is 1.8. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
8. Interpolation is permissible. Do not extrapolate.
9. Minimum allowable cfm is 300 cfm/ton.

Table 16 — 581B072 Air Delivery — Horizontal Discharge Units

AIRFLOW (Cfm)	BELT DRIVE MOTOR											
	External Static Pressure (in. wg)											
	0.1		0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1800	**885**	**0.63**	**942**	**0.73**	**1047**	**0.90**	1139	1.05	1193	1.14	1276	1.30
1900	**928**	**0.73**	**982**	**0.83**	**1084**	**1.02**	1160	1.11	1223	1.24	1301	1.38
2000	**971**	**0.84**	**1022**	**0.94**	1121	1.12	1188	1.22	1254	1.36	1329	1.44
2100	**1015**	**0.97**	**1063**	**1.10**	1140	1.18	1196	1.27	1272	1.45	1354	1.58
2200	**1060**	**1.10**	**1104**	**1.20**	1159	1.23	1229	1.41	1306	1.53	1363	1.70
2300	**1104**	**1.25**	1130	1.27	1196	1.37	1264	1.56	1340	1.66	1397	1.86
2400	1138	1.30	1174	1.37	1245	1.57	1305	1.63	1373	1.84	1440	1.95
2500	1183	1.43	1201	1.50	1284	1.65	1338	1.75	1402	1.99	1469	2.04
2600	1210	1.58	1246	1.67	1312	1.76	1366	1.96	1435	2.10	1494	2.19
2700	1254	1.76	1285	1.80	1354	1.95	1403	2.14	1474	2.21	1536	2.46
2800	1274	1.82	1304	1.85	1374	2.12	1459	2.25	1514	2.42	1570	2.66
2900	1318	1.95	1345	2.05	1412	2.32	1496	2.54	1529	2.61	1603	2.87
3000	1362	2.20	1378	2.30	1451	2.40	1534	2.66	1560	2.81	1611	3.01

AIRFLOW (Cfm)	BELT DRIVE MOTOR					
	External Static Pressure (in. wg)					
	1.2		1.4		1.6	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
1800	1341	1.40	1413	1.55	1474	1.58
1900	1374	1.53	1437	1.62	1490	1.67
2000	1396	1.66	1460	1.68	1509	1.77
2100	1413	1.75	1475	1.73	1529	1.92
2200	1434	1.81	1487	1.85	1554	2.07
2300	1459	1.88	1520	2.07	1576	2.24
2400	1502	2.06	1552	2.24	1604	2.42
2500	1524	2.24	1585	2.42	1638	2.60
2600	1552	2.40	1616	2.63	1671	2.80
2700	1584	2.61	1646	2.83	1706	2.97
2800	1624	2.85	1677	2.99	—	—
2900	1671	3.03	—	—	—	—
3000	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower Input to Fan

NOTES:
1. **Boldface** indicates field-supplied drive is required. (See Note 4.)
2. ▭ indicates field-supplied motor and drive required.
3. ——— indicates maximum usable bhp.
4. Motor drive range is 1120 to 1585 rpm. All other rpms require a field-supplied drive.
5. Values include losses for filters, units casing, and wet coils.
6. Maximum continuous bhp is 2.4. Extensive motor and electrical testing on these units ensures that the full range of the motor can be utilized with confidence. Using your fan motors up to the ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
7. Use of a field-supplied motor may affect wire sizing. Contact your local representative to verify.
8. Interpolation is permissible. Do not extrapolate.
9. Minimum allowable cfm is 300 cfm/ton.

CARE AND MAINTENANMCE

To ensure continuing high performance and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This combination heating/cooling unit should be inspected at least once each year by a qualified service person.

NOTE TO EQUIPMENT OWNER: Consult your local dealer about the availability of a maintenance contract.

⚠ **WARNING:** The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools, and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the User's Manual. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY AND POSSIBLE DAMAGE TO THIS EQUIPMENT.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.
3. Inspect fan motor and wheel for cleanliness and check lubrication each heating and cooling season. Clean and lubricate (if required) when necessary.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Check and inspect heating section before each heating season. Clean and adjust when necessary.
6. Check and clean vent screen if needed.

⚠ **WARNING:** Failure to follow these warnings could result in serious personal injury:

1. Turn off gas supply, *then* turn off electrical power to the unit before performing any maintenance or service on the unit.
2. Use extreme caution when removing panels and parts. As with any mechanical equipment, personal injury can result from sharp edges, etc.
3. Never place anything combustible either on, or in contact with, the unit.
4. Should overheating occur, or the gas supply fail to shut off, shut off the external main manual gas valve to the unit, *then* shut off the electrical supply.

I. AIR FILTER

⚠ **CAUTION:** Never operate the unit without a suitble air filter in the return-air duct system. Always replace the filter with the same dimensional size and type as originally installed. See Table 1 for recommended filter sizes.

Inspect air filter(s) at least once each month and replace (throwaway-type) or clean (cleanable-type) at least twice during each heating and cooling season and whenever the filter(s) becomes clogged with dust and lint.

When necessary, replace filters with the same dimensional size and type as originally provided.

SERVICE

⚠ **CAUTION:** When servicing unit, shut off all electrical power to unit to avoid shock hazard or injury from rotating parts.

I. CLEANING

Inspect unit interior at the beginning of each heating and cooling season and as operating conditions require.

A. Evaporator Coil

1. Turn unit power off. Remove evaporator coil access panel.
2. If economizer is installed, remove economizer by disconnecting economizer plug and removing mounting screws. See Fig. 18 and 19. Refer to Accessory Economizer Installation Instructions or Optional Economizer sections on pages 13 and 14 for further details.
3. Slide filters out of unit.
4. Clean coil using a commercial coil cleaner or dishwasher detergent in a pressurized spray canister. Wash both sides of coil and flush with clean water. For best results, backflush toward return-air section to remove foreign material.
5. Flush condensate pan.
6. Reinstall economizer and filters.
7. Reconnect wiring.
8. Replace access panels.

B. Condenser Coil

Inspect coil monthly. Clean condenser coil annually, and as required by location and outdoor-air conditions.

<u>One-Row Coil (size 036)</u>

Wash coil with commercial coil cleaner. It is not necessary to remove top panel.

<u>2-Row Coils (sizes 048-072)</u>

NOTE: Save all screws removed in this section. The screws must be used when reinstalling the equipment.

1. Turn off unit power.
2. Remove top panel screws on condenser end of unit.
3. Remove condenser coil corner post. See Fig. 35. To hold top panel open, place coil corner post between top panel and center post. See Fig. 36.
4. Remove screws securing coil to center post.
5. Remove fastener holding coil sections together at return end of condenser coil. Carefully separate the outer coil section 3 to 4 in. from the inner coil section. See Fig. 37.
6. Use a water hose or other suitable equipment to flush down between the 2 coil sections to remove dirt and debris. Clean the outer surfaces with a stiff brush in the normal manner.
7. Secure inner and outer coil rows together with a field-supplied fastener.
8. Reposition the outer coil section and remove the coil corner post from between the top panel and center post.
9. Reinstall the coil corner post and replace all screws.

C. Condensate Drain

Check and clean each year at start of cooling season. In winter, keep drain dry or protect against freeze-up.

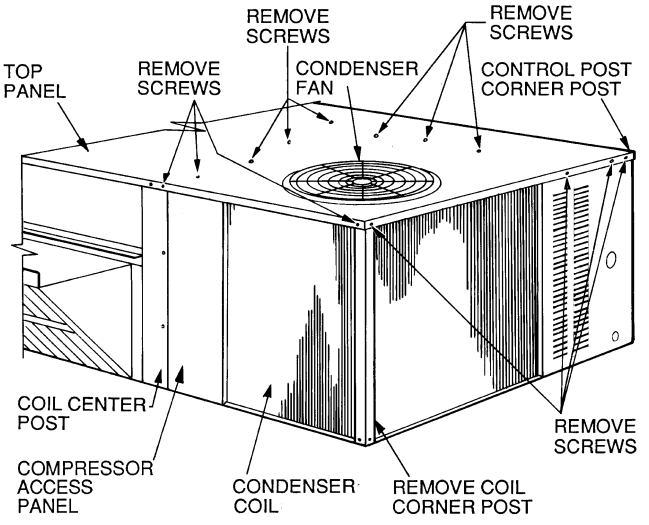


Fig. 35 — Cleaning Condenser Coil

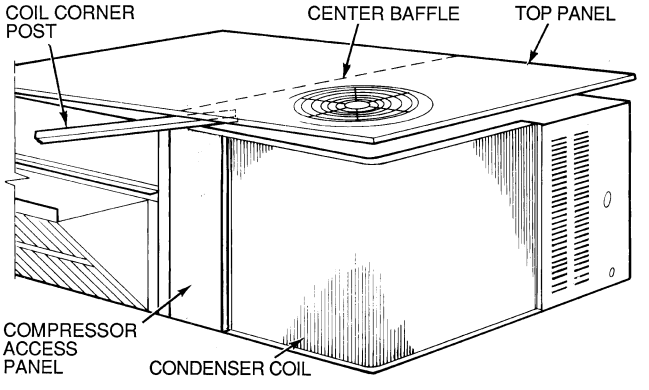


Fig. 36 — Propping Up Top Panel

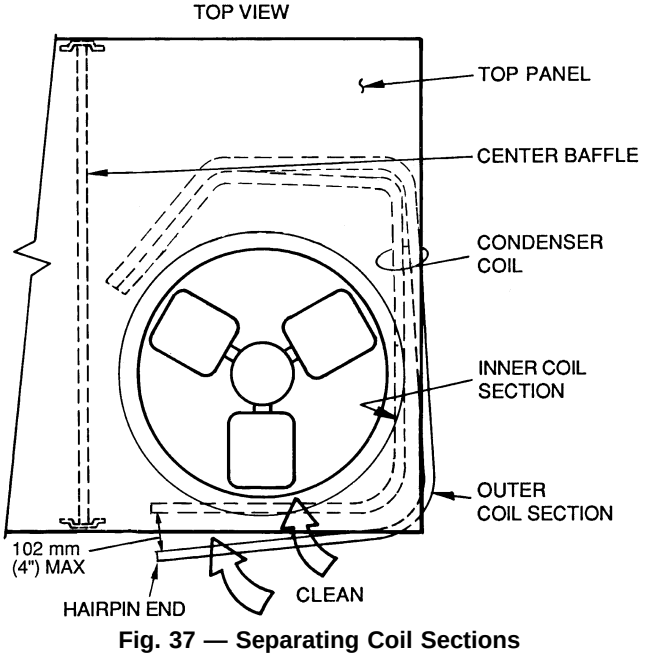


Fig. 37 — Separating Coil Sections

D. Filters

Clean or replace at start of each heating and cooling season, or more often if operating conditions require it. Replacement filters must be same dimensions as original filters.

E. Outdoor-Air Inlet Screens

Clean screens with steam or hot water and a mild detergent. Do not use disposable filters in place of screens.

II. LUBRICATION

A. Compressors

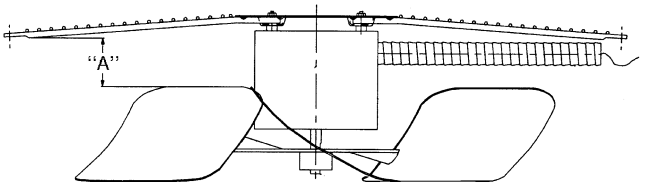
Each compressor is charged with the correct amount of oil at the factory.

B. Fan Motor Bearings

Fan motor bearings are of the permanently lubricated type. No further lubrication is required. No lubrication of condenser- or evaporator-fan motors is required.

III. CONDENSER-FAN ADJUSTMENT (Fig. 38)

1. Shut off unit power supply.
2. Remove condenser-fan assembly (grille, motor, motor cover, and fan).
3. Loosen fan hub setscrews.
4. Adjust fan height as shown in Fig. 38.
5. Tighten setscrews.
6. Replace condenser-fan assembly.



UNIT 581B	FAN HEIGHT (in.)
036-060 and, 072 (208/230 V)	2.75
072 (460 and 575 V)	3.50

Fig. 38 — Condenser Fan Adjustment

IV. ECONOMIZER ADJUSTMENT

Refer to Optional Economizer sections on pages 13 and 14.

V. REFRIGERANT CHARGE

Amount of refrigerant charge is listed on unit nameplate (also refer to Table 1). Refer to GTAC2-5 Charging, Recovery, Recycling, and Reclamation training manual and the following procedures. Unit panels must be in place when unit is operating during charging procedure.

This unit uses a fixed orifice refrigerant metering device located in the coil header. There is one orifice in each coil circuit. The size of the orifice is stamped on the outside of the tube where the orifice is located. Orifices are factory selected for optimum performance and are not designed to be changed in the field. To determine if an orifice has become plugged, disconnect power to the evaporator-fan motor and start the unit in cooling. Observe the coil for an uneven frost pattern, indicating a plugged orifice.

A. No Charge

Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant. (Refer to Table 1.)

B. Low Charge Cooling

Using Cooling Charging Charts, Fig. 39-42, vary refrigerant until the conditions of the appropriate chart are met. Note the charging charts are different from type normally used. Charts are based on charging the units to the correct superheat for the various operating conditions. Accurate pressure gage and temperature-sensing device are required. Connect the pressure gage to the service port on the suction line. Mount the temperature-sensing device on the suction line and insulate it so that outdoor ambient temperature does not affect the reading. Indoor-air cfm must be within the normal operating range of the unit.

C. To Use Cooling Charging Charts

Take the outdoor ambient temperature and read the suction pressure gage. Refer to appropriate chart to determine what suction temperature should be. If suction temperature is high, add refrigerant. If suction temperature is low, carefully reclaim some of the charge. Recheck the suction pressure as charge is adjusted.

EXAMPLE: (Fig. 41)

Outdoor Temperature ..... 85 F
Suction Pressure ..... 74 psig
Suction Temperature should be ..... 48 F
(Suction Temperature may vary ± 5 F.)

D. Refrigerant Leaks

Proceed as follows to repair a refrigerant leak and to charge the unit:

1. Locate leak and ensure that refrigerant system pressure has been relieved.
2. Repair leak following accepted practices.

NOTE: Replace filter drier in the liquid line whenever the system has been opened for repair.

3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Evacuate refrigerant system if additional leaks are not found.
5. Charge unit with R-22 refrigerant, using a volumetric-charging cylinder or accurate scale. *Refer to unit rating plate for required charge.* Be sure to add extra refrigerant to compensate for internal volume of filter drier.

VI. MAIN BURNERS

At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust if necessary.

VII. FLUE GAS PASSAGEWAYS

To inspect the flue collector box and upper areas of the heat exchanger:

1. Remove the combustion blower wheel and motor assembly according to directions in Combustion-Air Blower section below.
2. Remove the 3 screws holding the blower housing to the flue cover.
3. Remove the flue cover to inspect the heat exchanger.
4. Clean all surfaces as required using a wire brush.

VIII. COMBUSTION-AIR BLOWER

Clean periodically to ensure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bimonthly to determine proper cleaning frequency.

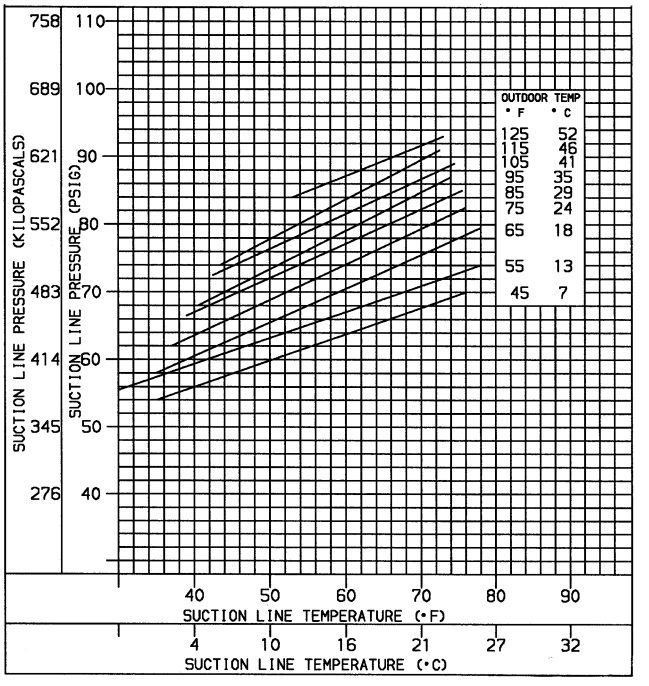


Fig. 39 — Cooling Charging Chart, 581B036

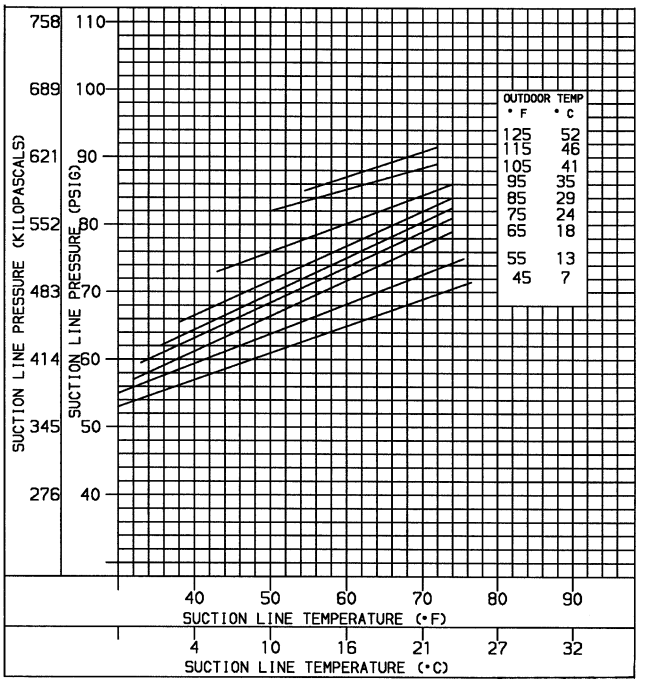


Fig. 40 — Cooling Charging Chart, 581B048

To inspect blower wheel, remove draft hood and screen. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel as follows:

1. Slide burner access panel out.
2. Remove the 2 screws which hold the heat shield in place, and remove heat shield.
3. Remove the 7 screws that attach induced-draft motor mounting plate to blower housing (Fig. 43).

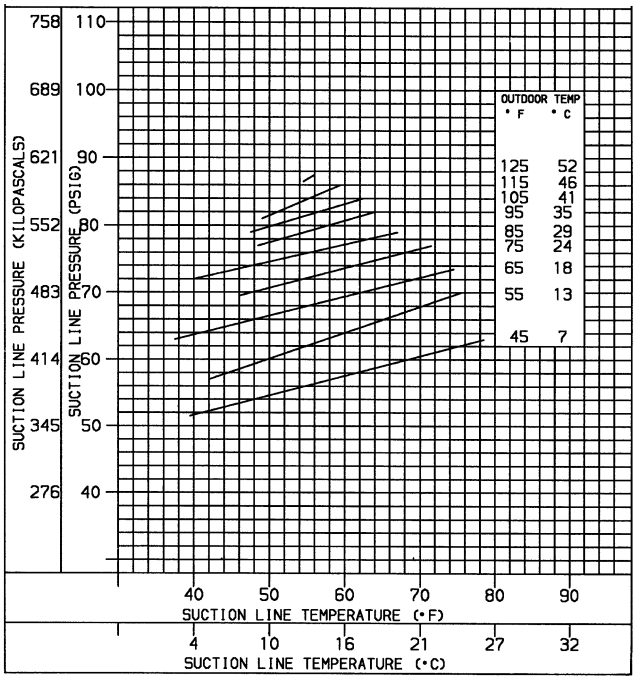


Fig. 41 — Cooling Charging Chart, 581B060

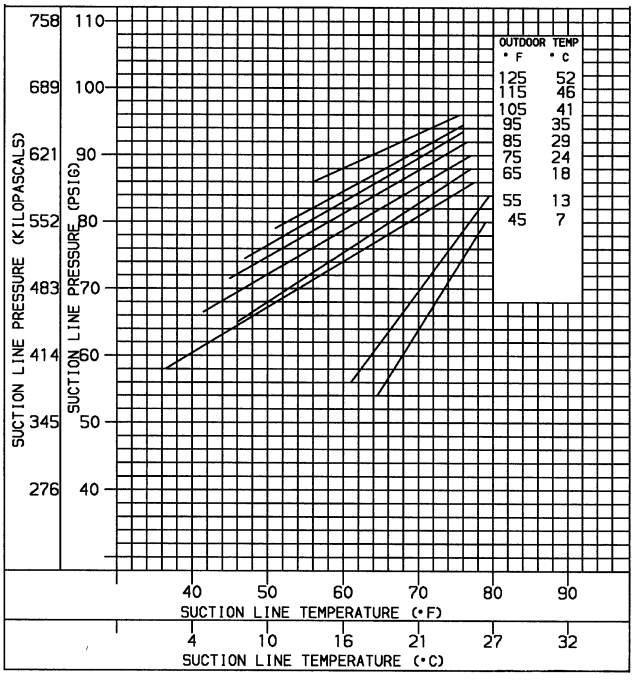


Fig. 42 — Cooling Charging Chart, 581B072

4. Slide the motor and blower wheel assembly out of the blower housing. The blower wheel can be cleaned at this point. If additional cleaning is required, continue with steps 5 and 6.
5. To remove blower from the motor shaft, remove 2 setscrews.
6. To remove motor, remove 4 screws that hold the motor to mounting plate. Remove the motor cooling fan by removing one setscrew. Then remove nuts that hold motor to mounting plate.
7. To reinstall, reverse the procedure outlined above.

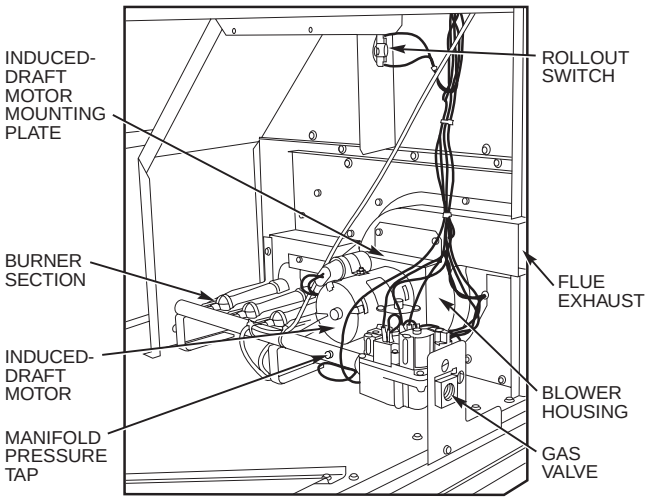


Fig. 43 — Burner Section Details

IX. LIMIT SWITCH

Remove blower access panel (Fig. 2). Limit switch is located on the fan deck.

X. BURNER IGNITION

Unit is equipped with a direct spark ignition 100% lockout system. Integrated Gas Unit Controller (IGC) is located in the control box (Fig. 15). The IGC contains a self-diagnostic LED (light-emitting diode). A single LED on the IGC provides a visual display of operational or sequential problems when the power supply is uninterrupted. When a break in power occurs, the IGC will be reset (resulting in a loss of fault history). The indoor (evaporator) fan ON/OFF times will also be reset. The LED error code can be observed through the viewport. During servicing refer to the label on the control box cover or Table 17 for an explanation of LED error code descriptions.

If lockout occurs, unit may be reset by interrupting the power supply to unit for at least 5 seconds.

⚠ **CAUTION:** When servicing gas train, do not hit or plug orifice spuds.

Table 17 — LED Error Code Description*

LED INDICATION	ERROR CODE DESCRIPTION
ON	Normal Operation
OFF	Hardware Failure
1 Flash†	Evaporator Fan On/Off Delay Modified
2 Flashes	Limit Switch Fault
3 Flashes	Flame Sense Fault
4 Flashes	4 Consecutive Limit Switch Faults
5 Flashes	Ignition Lockout Fault
6 Flashes	Induced-Draft Motor Fault
7 Flashes	Rollout Switch Fault
8 Flashes	Internal Control Fault

LEGEND

LED — Light-Emitting Diode

*A 3-second pause exists between LED error code flashes. If more than one error code exists, all applicable codes will be displayed in numerical sequence.

†Indicates a code that is not an error. The unit will continue to operate when this code is displayed.

IMPORTANT: Refer to Troubleshooting Tables 18-22 for additional information.

A. Removal and Replacement of Gas Train (See Fig. 31 and 43.)

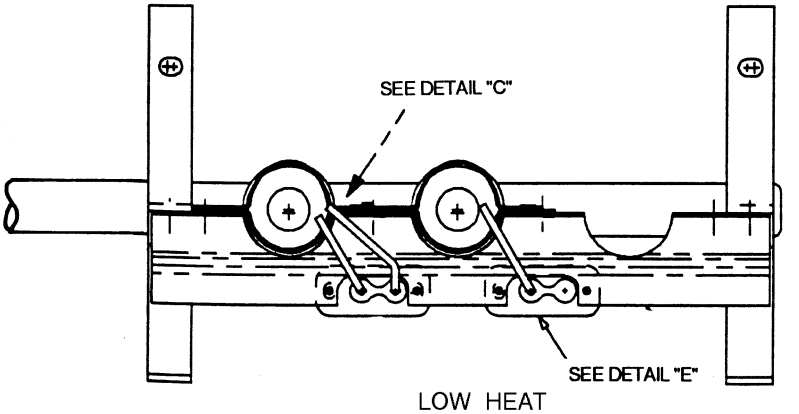
1. Shut off manual gas valve.
2. Shut off power to unit.
3. Remove compressor access panel.
4. Slide out burner compartment side panel.
5. Remove heat shield.
6. Disconnect gas piping at unit gas valve.
7. Remove wires connected to gas valve. Mark each wire.
8. Remove induced-draft motor, ignitor, and sensor wires at the Integrated Gas Unit Controller (IGC).
9. Remove the 2 screws that attach the burner rack to the vestibule plate.
10. Remove the gas valve bracket.
11. Slide the burner tray out of the unit (Fig. 31).
12. To reinstall, reverse the procedure outlined above.

B. Cleaning and Adjustment

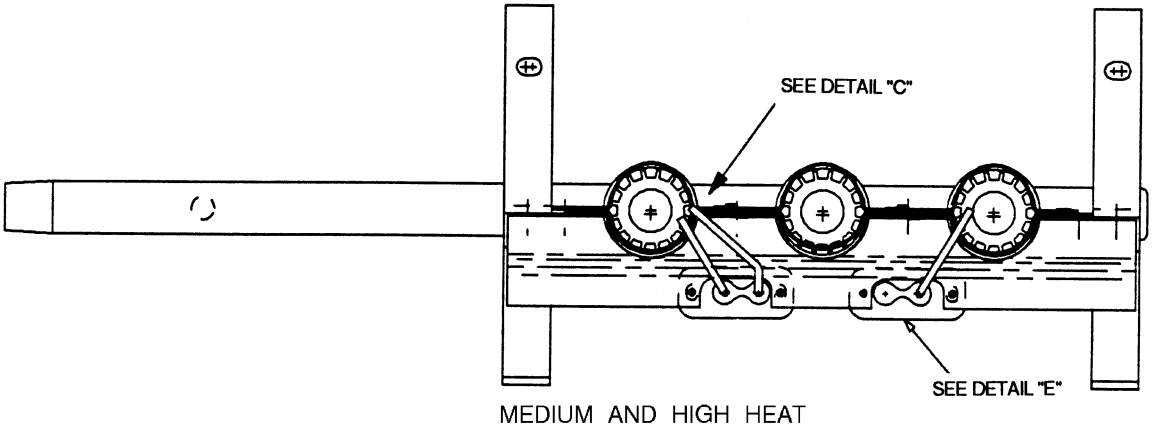
1. Remove burner rack from unit as described in Removal and Replacement of Gas Train section above.
2. Inspect burners; if dirty, remove burners from rack.
3. Using a soft brush, clean burners and crossover port as required.
4. Adjust spark gap. See Fig. 44.
5. Reinstall burners on rack.
6. Reinstall burner rack as described in Removal and Replacement of Gas Train section above.

XI. REPLACEMENT PARTS

A complete list of replacement parts may be obtained from your distributor upon request.



LOW HEAT
581B036072 – 581B072072 — 72,000 BTUH INPUT



MEDIUM AND HIGH HEAT
581B036115 – 581B072115 — 115,000 BTUH INPUT
581B048150 – 581B072150 — 150,000 BTUH INPUT

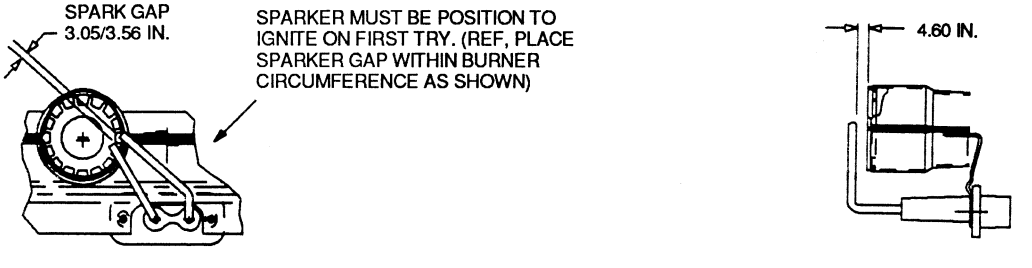

SPARK GAP
3.05/3.56 IN.
SPARKER MUST BE POSITION TO IGNITE ON FIRST TRY. (REF, PLACE SPARKER GAP WITHIN BURNER CIRCUMFERENCE AS SHOWN)
4.60 IN.
DETAIL "C"
DETAIL 'E'

Fig. 44 — Spark Adjustment

Table 18 — LED Error Code Service Analysis

PROBLEM	CAUSE	REMEDY
Hardware failure. (LED Off)	Loss of power to IGC.	Check 5-amp fuse on IGC, power to unit, 24-v circuit breaker, and transformer. Units without a 24-v circuit breaker have an internal overload in the 24-v transformer. If the overload trips, allow 10 minutes for automatic reset.
Limit switch fault. (LED 2 Flashes)	High-temperature limit switch is open.	Check the operation of the indoor (evaporator) fan motor. Ensure that the supply-air temperature rise is in accordance with the range on the unit nameplate.
Flame sense fault. (LED 3 Flashes)	The IGC sensed flame that should not be present.	Reset unit. If problem persists, replace control board.
4 consecutive limit switch trips. (LED 4 Flashes)	Inadequate airflow to unit.	Check operation of indoor (evaporator) fan motor and that supply-air temperature rise agrees with range on unit nameplate information.
Ignition lockout. (LED 5 Flashes)	Unit unsuccessfully attempted ignition for 15 minutes.	Check ignitor and flame sense electrode spacing, gas, etc. Ensure that flame sense and ignition wires are properly terminated. Verify that unit is obtaining proper amount of gas.
Induced-draft motor fault. (LED 6 Flashes)	IGC does not sense that induced-draft motor is operating.	Check for proper voltage. If motor is operating, check the speed sensor plug/IGC Terminal J2 connection. Proper connection: PIN 1-White, PIN 2-Red, PIN 3-Black.
Rollout switch fault. (LED 7 Flashes)	Rollout switch has opened.	Rollout switch will automatically reset, but IGC will continue to lock out unit. Check gas valve operation. Ensure that induced-draft blower wheel is properly secured to motor shaft. Reset unit at unit disconnect.
Internal control fault. (LED 8 Flashes)	Microprocessor has sensed an error in the software or hardware.	If error code is not cleared by resetting unit power, replace the IGC.

LEGEND

IGC — Integrated Gas Unit Controller
LED — Light-Emitting Diode

⚠ **WARNING:** If the IGC must be replaced, be sure to ground yourself to dissipate any electrical charge that may be present before handling new control board. The IGC is sensitive to static electricity and may be damaged if the necessary precautions are not taken.

IMPORTANT: Refer to Table 19 — Heating Service Analysis for additional troubleshooting analysis.

Table 19 — Heating Service Analysis

PROBLEM	CAUSE	REMEDY
Burners will not ignite.	Misaligned spark electrodes.	Check flame ignition and sensor electrode positioning. Adjust as needed.
	No gas at main burners.	Check gas line for air, purge as necessary. After purging gas line of air, allow gas to dissipate for at least 5 minutes before attempting to relight unit.
		Check gas valve.
	Water in gas line.	Drain water and install drip leg to trap water.
	No power to furnace.	Check power supply, fuses, wiring, and circuit breaker.
	No 24 v power supply to control circuit.	Check transformer. Transformers with internal overcurrent protection require a cool down period before resetting. Check 24-v circuit breaker, reset as necessary.
	Miswired or loose connections.	Check all wiring and wirenut connections.
	Burned-out heat anticipator in thermostat.	Replace thermostat.
	Broken thermostat wires.	Run continuity check. Replace wires, if necessary.
Inadequate heating.	Dirty air filter.	Clean or replace filter as necessary.
	Gas input to unit too low.	Check gas pressure at manifold. Clock gas meter for input. If too low, increase manifold pressure, or replace with correct orifices.
	Unit undersized for application.	Replace with proper unit or add additional unit.
	Restricted airflow.	Clean filter, replace filter, or remove any restrictions.
	Blower speed too low.	Install field-supplied motor and drive or adjust pulley to increase fan speed.
	Limit switch cycles main burners.	Check rotation of blower, thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.
	Too much outdoor air.	Adjust minimum position.
		Check economizer operation.
Poor flame characteristics.	Incomplete combustion (lack of combustion air) results in:	Check all screws around flue outlets and burner compartment. Tighten as necessary.
	Aldehyde odors, carbon monoxide, sooting flame, or floating flame.	Cracked heat exchanger.
		Overfired unit — reduce input, change orifices, or adjust gas line or manifold pressure.
		Check vent for restriction. Clean as necessary.
		Check orifice to burner alignment.
Burners will not turn off.	Unit is locked into Heating mode for a one minute minimum.	Wait until mandatory one minute time period has elapsed or reset power to unit.

Table 20 — Cooling Service Analysis

PROBLEM	CAUSE	REMEDY
Compressor and condenser fan will not start.	Power failure.	Call power company.
	Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, control relay or capacitor.	Replace component.
	Insufficient line voltage.	Determine cause and correct.
	Incorrect or faulty wiring.	Check wiring diagram and rewire correctly.
	Thermostat setting too high.	Lower thermostat setting below room temperature.
Compressor will not start but condenser fan runs.	Faulty wiring or loose connections in compressor circuit.	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open.	Determine cause. Replace compressor.
	Defective run/start capacitor, overload, start relay.	Determine cause and replace.
	One leg of of 3-phase power dead.	Replace fuse or reset circuit breaker. Determine cause.
Compressor cycles (other than normally satisfying thermostat).	Refrigerant overcharge or undercharge.	Reclaim refrigerant, evacuate system, and recharge to nameplate.
	Defective compressor.	Replace and determine cause.
	Insufficient line voltage.	Determine cause and correct.
	Blocked condenser.	Determine cause and correct.
	Defective run/start capacitor, overload, or start relay.	Determine cause and replace.
	Defective thermostat.	Replace thermostat.
	Faulty condenser-fan motor or capacitor.	Replace.
	Restriction in refrigerant system.	Locate restriction and remove.
Compressor operates continuously.	Dirty air filter.	Replace filter.
	Unit undersized for load.	Decrease load or increase unit size.
	Thermostat set too low.	Reset thermostat.
	Low refrigerant charge.	Locate leak; repair and recharge.
	Leaking valves in compressor.	Replace compressor.
	Air in system.	Reclaim refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted.	Clean coil or remove restriction.
Compressor makes excessive noise.	Compressor rotating in wrong direction.	Reverse the 3-phase motor power leads as described in Start-Up on page 17.
Excessive head pressure.	Dirty air filter.	Replace filter.
	Dirty condenser coil.	Clean coil.
	Refrigerant overcharged.	Reclaim excess refrigerant.
	Air in system.	Reclaim refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short-cycling.	Determine cause and correct.
Head pressure too low.	Low refrigerant charge.	Check for leaks; repair and recharge.
	Compressor valves leaking.	Replace compressor.
	Restriction in liquid tube.	Remove restriction.
	Compressor rotating in wrong direction	Reverse the 3-phase motor power leads as described in Start-Up on page 17.
Excessive suction pressure.	High heat load.	Check for source and eliminate.
	Compressor valves leaking.	Replace compressor.
	Refrigerant overcharged.	Reclaim excess refrigerant.
	Compressor rotating in wrong direction.	Reverse the 3-phase motor power leads as described in Start-Up on page 17.
Suction pressure too low.	Dirty air filter.	Replace filter.
	Low refrigerant charge.	Check for leaks; repair and recharge.
	Metering device or low side restricted.	Remove source of restriction.
	Insufficient evaporator airflow.	Increase air quantity. Check filter and replace if necessary.
	Temperature too low in conditioned area.	Reset thermostat.
	Outdoor ambient below 25 F.	Install low-ambient kit.
Evaporator fan will not shut off.	Time off delay not finished.	Wait for 30-second off delay.

Table 21 — Varislide™ Economizer Troubleshooting

PROBLEM	CAUSE	REMEDY
Damper does not open.	Indoor (evaporator) fan is off.	1. Check to ensure that 24 vac is present at terminal C1 on the IFC or that 24 vac is present at the IFO terminal. Check whether 24 vac is present at PL6-1 (red wire) and/or PL6-3 (black wire). If 24 vac is not present, check wiring (see unit label diagram). 2. Check proper thermostat connection to G on the connection board.
	No power to economizer motor.	1. Check that SW3 is properly making contact with the damper blade. Check that SW1 is in the NC (normally closed) position. 2. Check diode D18. If diode is not functioning properly, replace economizer control board. 3. Confirm that the economizer control board is grounded properly at PL6-4 (brown wire) and at brown terminal of the economizer control board (brown wire). The economizer motor must also be grounded properly at the negative motor terminal (brown wire). 4. Verify SW1 and SW3 are working and wired properly (see unit label diagram). 5. Check for 24 vac input at both PL6-1 (red wire) and PL6-3 (black wire). If 24 vac not present, check unit wiring (see unit label diagram). If 24 vac is found in both places, check for 24 vac at the yellow terminal of the economizer control board (yellow wire). If 24 vac power is not present, replace the economizer control board.
	Economizer motor failure.	If the indoor (evaporator) fan and economizer motor are energized, verify that there is a minimum of 18 vdc at the positive motor terminal. If the motor is not operating, replace the motor.
Economizer operation limited to minimum position.	OAT or EC set too high.	1. Set at correct temperature (3 F below indoor space temperature). 2. Check OAT or EC by setting above outdoor temperature or humidity level. If the OAT or EC switches do not close, replace OAT or EC.
	Economizer control board incorrectly wired or not functioning.	1. Perform the following tests when OAT or EC is closed, Y1 is called for, and damper is at minimum position. Confirm 24 vac on gray terminal of the economizer control board (gray wire). If 24 vac is not present, check wiring (see unit label diagram). 2. Verify that SW1 and SW3 are wired correctly and working properly (see unit label diagram). 3. Check to ensure that 24 vac exists at PL6-2 (blue wire). If 24 vac is not present, check wiring (see unit wiring label diagram). 4. Check 24 vac output at PL6-10 (white wire). If 24 vac is not present, replace economizer control board.
	Incorrect SAT wiring or inoperative SAT.	1. After verifying that the OAT and EC settings and the economizer control board wiring are correct, check to ensure that the 24 vac terminal of the SAT has 24 vac (white wire). If OAT, EC, and control board are functioning and wired properly and no 24 vac exists, check wiring (see unit label diagram). 2. If supply-air temperature is greater than 57 F, 24 vac should be found at terminal T2 on the SAT (pink wire). If 24 vac is not present, replace SAT.
Damper does not close.	Incorrect economizer wiring.	1. Verify that SW2 and SW4 are wired and working properly (see unit label diagram). 2. Check diode D19. If diode is not functioning properly, replace economizer control board.
	Incorrect damper actuator wiring or inoperative economizer circuit board.	1. After verifying that the wiring is correct, modulate the damper to the minimum position. Remove the calls for G. 2. If the damper does not move, check for 24 vac at PL6-1 (red wire). If 24 vac is not present, check wiring (see unit label diagram). 3. If damper still does not move, check for 24 vac at blue terminal of economizer control board (blue wire). If 24 vac is not present, replace the economizer control board.
	Incorrect SAT wiring or inoperative SAT.	1. After verifying that the wiring is correct and the economizer control board is functioning properly, place the OAT or EC switch in the closed position. Place a call for Y1 and open the damper to the fully open position. Confirm that the 24 vac terminal of the SAT has 24 vac (white wire). If 24 vac is not present, check wiring (see unit label diagram). 2. If supply-air temperature is less than 52 F, 24 vac should be found at terminal T1 on the SAT (violet wire). If 24 vac not found, replace SAT.
	Economizer motor failure.	If economizer control board and SAT are functioning properly, verify that there is a minimum of 18 vdc at the positive motor terminal. If a minimum of 18 vdc is present and the motor is still not operating, replace the motor.
Economizer damper does not close on power loss.	Insufficient battery power, inoperative economizer control board.	1. Check voltage potential across batteries. If lower than 14 vdc, replace close-on-power-loss power supply (9-v alkaline batteries). Check this emergency power supply on a regular basis or whenever the filters are changed. 2. If the close-on-power-loss and economizer control board are functioning properly, check for 14 vdc or higher at the blue terminal of the economizer control board (blue wire) when power is disconnected from unit. If 14 vdc is not present, replace the control board.

LEGEND

CI — Common
EC — Enthalpy Control
IFC — Indoor (Evaporator) Fan Contactor
IFO — Indoor (Evaporator) Fan On
OAT — Outdoor-Air Thermostat
PL — Plug
SAT — Supply-Air Thermostat
SW — Economizer Position Switch

Table 22 — PARABLADE Economizer Troubleshooting

PROBLEM	CAUSE	REMEDY
Damper does not open.	Evaporator fan not on.	Check wiring between G on connection board and indoor fan contactor.
	No power to economizer motor.	1. Disconnect power at TR and TR1. Disconnect jumper across P and P1. 2. Connect jumper across TR and 1. 3. Connect jumper across T1 and T. 4. If connected, remove enthalpy sensor from terminals S_0 and +. Factory-installed 620 ohm resistor should be connected to terminals S_R and +. 5. Apply power (24 vac) to terminals TR and TR1. The LED should be off and the damper should be in the closed position. 6. Disconnect the factory-installed 620 ohm resistor from terminals S_R and +. The LED should light up and the motor should drive towards open. If this does not happen, replace the economizer control module.
	Economizer motor failure.	If the indoor fan and economizer motor are energized, verify that there is a minimum of 24 vac at terminals TR and TR1. If the motor is not operating, replace the motor.
Economizer operation limited to minimum position.	Economizer control module failure.	1. To simulate high or low enthalpy, reconnect the factory-installed 620 ohm resistor across terminals S_R and +. 2. Connect 1.2 Kohm checkout resistor across terminals S_O and +. Turn the enthalpy set point to "A." The LED should turn on, indicating low enthalpy. The motor should drive towards open. If LED does not light, replace module. If motor does not drive open, check motor operation. 3. Turn the enthalpy set point to "D." The LED should turn off, indicating high enthalpy. The motor should drive towards closed. If these actions do not occur, replace module. 4. Disconnection 1.2 Kohm checkout resistor before resuming operation.
Damper does not close.	No power to economizer.	1. Disconnect power at TR and TR1. Disconnect jumper across P and P1. 2. Connect jumper across TR and 1. 3. Connect jumper across T1 and T. 4. If connected, remove enthalpy sensor from terminals S_O and +. Factory-installed 620 ohm resistor should be connected to terminals S_R and +. 5. Apply power (24 Vac) to terminals TR and TR1. The LED should be off and the damper should be in the closed position. 6. Disconnect the factory-installed 620 ohm resistor from terminals S_R and +. The LED should light up and the motor should drive towards open. If this does not happen, replace the economizer control module.
	Return spring failure.	If power to unit is off and damper does not close, check for a bound linkage. If linkage is not bound, then internal spring may be broken. Replace actuator.
	Economizer motor failure.	If the economizer control module is functioning properly, verify that there is a minimum of 24 Vac at terminals TR and TR1. If the motor is not operating, replace the motor.
Damper does not open or close according to enthalpy readings.	Sensor incorrectly wired or bad.	To verify sensor operation, reconnect the + lead of the outdoor enthalpy sensor to the + terminal of the economizer control module. Connect a DC milliammeter between terminals S_O of the economizer control module and terminals S of the enthalpy sensor. The milliammeter should indicate between 3 and 25 mA if the sensor is operating properly. If the milliammeter indicates 0, the sensor may be wired backwards. If any other readings are shown, replace the sensor.

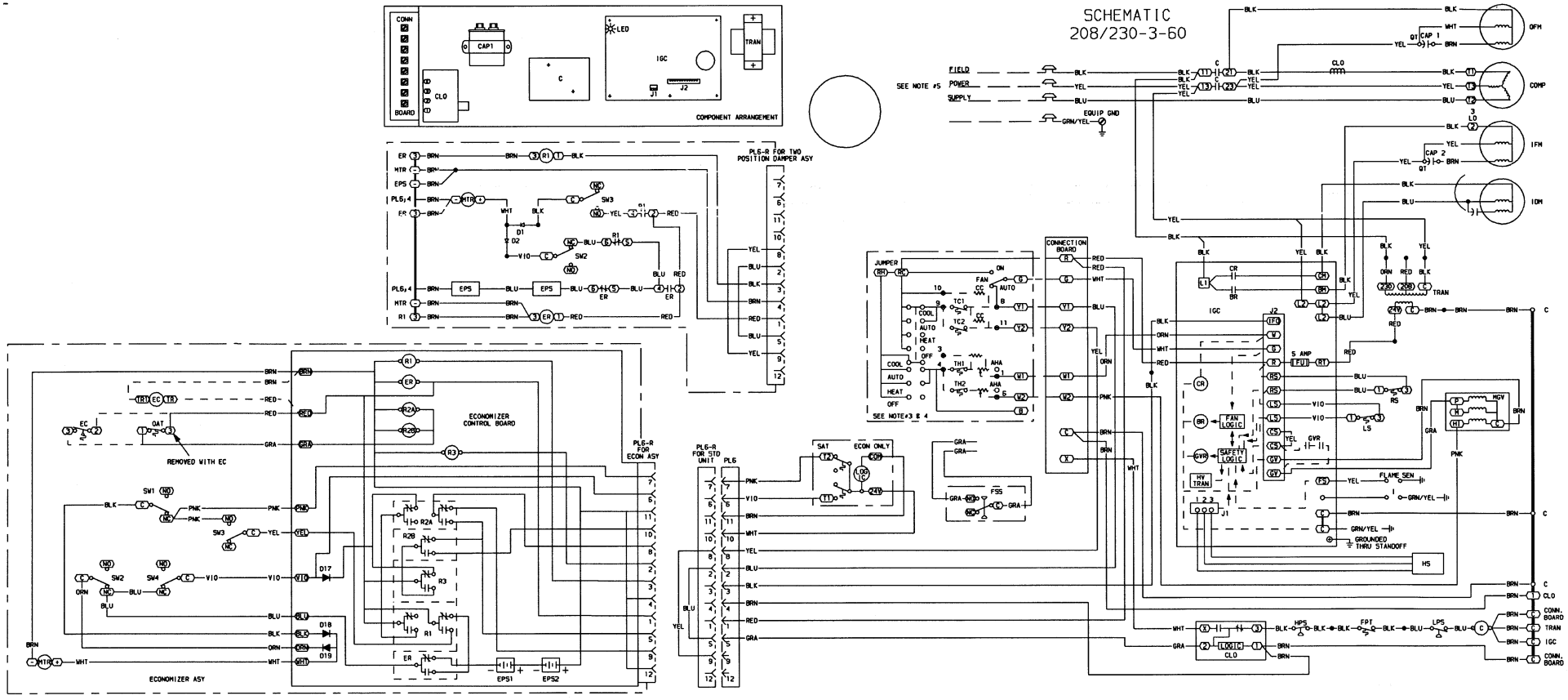


Fig. 45 — Typical Wiring Schematic and Component Arrangement

LEGEND AND NOTES FOR FIG. 45 — TYPICAL CONTROL WIRING SCHEMATIC AND COMPONENT ARRANGEMENT

AHA — Adjustable Heat Anticipator
C — Contactor, Compressor
CAP — Capacitor
CC — Cooling Compensator
CLO — Compressor Lockout
COMP — Compressor Motor
D — Diode
EC — Enthalpy Control
ECON — Economizer
EPS — Emergency Power Supply (9-V Battery)
EQUIP — Equipment
ER — Economizer Relay
FPT — Freeze-Protection Thermostat
FU — Fuse
GND — Ground
HPS — High-Pressure Switch
HS — Hall Effect Sensor
I — Ignitor
IDM — Induced Draft Motor
IFC — Indoor-Fan Contactor
IFM — Indoor-Fan Motor
IGC — Integrated Gas Unit Controller
LPS — Low-Pressure Switch
LS — Limit Switch
MGV — Main Gas Valve
MTR — Motor
OAT — Outdoor-Air Thermostat
OFM — Outdoor-Fan Motor
P — Plug
PL — Plug Assembly
QT — Quadruple Terminal
R — Relay
RS — Rollout Switch
SAT — Supply-Air Thermostat
SEN — Sensor
SW1 — Switch Fully Open
SW2 — Switch Fully Closed
SW3 — Switch Minimum Vent Position
SW4 — Switch Maximum Vent Position
TC — Thermostat-Cooling
TH — Thermostat-Heating
TRAN — Transformer

Field Splice

Marked Wire

Terminal (Marked)

Terminal (Unmarked)

Terminal Block

Splice

Factory Wiring

Field Control Wiring

Field Power Wiring

Accessory or Optional Wiring

To indicate common potential only, not to represent wiring.

NOTES:
1. Replace original wire with type 90 C wire or its equivalent.
2. Three-phase motors are protected under primary single-phasing conditions.
3. Use thermostats: HH07AT170,172
   Subbases: HH93AZ176, 177, 178, and 179
4. Set heat anticipator at .14 amp for first stage and .14 amp for second stage.
5. Use copper conductors only.
6. TRAN is wired for 230 V unit. If unit is to be run with 208 V power supply, disconnect BLK wire from 230 V tap and connect to 208 V tap (RED). Insulate end of 230 V tap.

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START-UP CHECKLIST

(Remove and Store in Job File)

I. PRELIMINARY INFORMATION

MODEL NO.: _____ SERIAL NO.: _____

DATE: _____ TECHNICIAN: _____

II. PRE-START-UP (insert checkmark in box as each item is completed)

☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT

☐ REMOVE ALL SHIPPING HOLDDOWN BOLTS AND BRACKETS PER INSTALLATION INSTRUCTIONS

☐ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTALLATION INSTRUCTIONS

☐ CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS

☐ CHECK GAS PIPING FOR LEAKS

☐ CHECK THAT INDOOR-AIR FILTER IS CLEAN AND IN PLACE

☐ VERIFY THAT UNIT INSTALLATION IS LEVEL

☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE AND SETSCREW TIGHTNESS

III. START-UP

ELECTRICAL

SUPPLY VOLTAGE L1-L2 _____ L2-L3 _____ L3-L1 _____

COMPRESSOR AMPS L1 _____ L2 _____ L3 _____

INDOOR-FAN AMPS L1 _____ L2 _____ L3 _____

TEMPERATURES

OUTDOOR-AIR TEMPERATURE _____ DB

RETURN-AIR TEMPERATURE _____ DB _____ WB

COOLING SUPPLY AIR _____

GAS HEAT SUPPLY AIR _____

PRESSURES

GAS INLET PRESSURE _____ IN. WG

GAS MANIFOLD PRESSURE _____ IN. WG (HI FIRE)

REFRIGERANT SUCTION _____ PSIG

REFRIGERANT DISCHARGE _____ PSIG

☐ VERIFY REFRIGERANT CHARGE USING CHARGING TABLES

☐ VERIFY THAT 3-PHASE SCROLL COMPRESSOR ROTATING IN CORRECT DIRECTION

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE

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